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AIR COMMAND AND STAFF COLLEGE

STUDENT REPORT

DESIGN OF SURVEILLANCE PLANS
FOR TACTICAL MISSILES
IN LONG TERM STORAGE

Major Buddy B. Wood 85-2915

"insights into tomorrow"

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TITLE DESIGN OF SURVEILLANCE PLANS FOR TACTICAL MISSILES IN LONG TERM STORAGE

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Following factory production and check-out, tactical missiles of today are shipped directly to tactical units where they are stored for extended periods of time as a part of our war reserve material. Both a pre-storage test and a periodic surveillance test are typically performed using automated test equipment (ATE) to keep the reliability of the inventory above some threshold. This report improves the efficiency of these test programs by (1) tabulating the ATE diagnostic error probabilities required to establish an initial inventory reliability and (2) tabulating the sample proportions required to keep the reliability above some threshold for ten years of storage.

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PREFACE

Following factory production and check-out, tactical missiles of today are shipped directly to tactical units where they are stored for extended periods of time as a part of our war reserve material. Both a pre-storage test and a periodic surveillance test are typically performed using automated test equipment (ATE) to keep the reliability of the inventory above some threshold. Design of ATE to accurately check missile electronics continues to progress, but 100 percent accuracy is an elusive goal. As a result, two types of diagnostic errors can occur: (1) alpha error, or diagnosing a good missile as bad and (2) beta error, or diagnosing a bad missile as good. This report improves the efficiency of both pre-storage and surveillance test programs by relating these error probabilities to the reliability of the missile inventory.

For the pre-storage test, tables are provided to identify values of ATE alpha and beta error probabilities which will provide a desired initial inventory storage reliability. The following inputs are required for use of the tables: initial production reliability, test damage probability, and the desired initial inventory reliability. The resulting error probabilities are meaningful inputs for ATE specifications.

For the surveillance test, tables are provided which identify the sample surveillance proportion required to keep inventory reliability above some threshold value. The following inputs are required for use of the tables: initial production reliability, test damage probability, missile average life, both alpha and beta error probabilities, and the desired minimum inventory reliability after ten years of storage. The resulting sample proportion is useful in developing the maintenance support system for the missile inventory.

Many people have assisted in this research effort. My advisor, Major Mark Warner, provided the guiding light and was a constant source of encouragement. Dr. Keith Giffin offered valuable insight into the quantification of initial inventory reliability. I must also thank my devoted wife, Penny, for her invaluable assistance with the statistical applications and for her painstaking editorial review.

ABOUT THE AUTHOR

Major Wood [redacted] and has BS and MS degrees in Engineering and Statistics from Mississippi State University. After receiving his commission through ROTC, he was assigned to Sacramento Air Logistics Center where he worked a variety of project engineering assignments on the A-10, F-111, and Space Shuttle systems. He then completed SOS in residence and served as a reliability staff officer for Eglin's Armament Division. At Eglin Major Wood was responsible for directing or supporting the reliability programs associated with the Sparrow, Sidewinder and AMRAAM missile systems. Prior to entering ACSC, Major Wood was Assistant Professor of Mathematics at the US Air Force Academy where he directed courses in statistics and developed an entire course in reliability. He has been involved in the American Defense Preparedness Association, the Air Force Association, and the International Technical Cooperative Program and has authored numerous articles for publication in professional journals. His most recent work "Bayesian Reliability Test Plans For One-Shot Devices" won Air Force's highest award given to an individual for research - the Harold Brown Award.

TABLE OF CONTENTS

Preface -- iii
About the Author ------------------------------------- iv
List of Illustrations -------------------------------- vi
Executive Summary ------------------------------------ vii

CHAPTER ONE - INTRODUCTION AND BACKGROUND
The Tactical Missile Life Profile ------------- 1
Long Term Storage ------------------------------ 1
Storage Tests ---------------------------------- 4
Test Diagnostic Errors ------------------------- 4
Problem Statement ------------------------------ 5

CHAPTER TWO - PRE-STORAGE TESTING
The Simple Analytical Model -------------------- 6
The Measure of Effectiveness ------------------- 8
Problem Statement ------------------------------ 8
Model Limitations ------------------------------ 9

CHAPTER THREE - SURVEILLANCE TESTING
The Simple Analytical Model -------------------- 10
The Measure of Effectiveness ------------------- 13
Model Application ------------------------------ 15
Use of Tables ---------------------------------- 15
Limitations of the Surveillance Model --------- 16

CHAPTER FOUR - CONCLUSIONS AND RECOMMENDATIONS
Conclusions ------------------------------------ 17
Recommendations -------------------------------- 17

APPENDICES:
Appendix A - Pre-Storage Computer Program ----- 21
Appendix B - Tables for Pre-Storage Testing --- 24
Appendix C - Surveillance Computer Program ---- 35
Appendix D - Tables For Surveillance Testing -- 38

LIST OF ILLUSTRATIONS

TABLES

TABLE 1 - Missiles Following Typical Profile --------- 3

TABLE 2 - Definition of Events for Surveillance ------ 12

FIGURES

FIGURE 1 - Simplified Mission Profile --------------- 2

FIGURE 2 - Pre-Storage Testing -------------------- 7

FIGURE 3 - Surveillance Testing Model -------------- 11

FIGURE 4 - Surveillance Receiving Inspection -------- 14

EXECUTIVE SUMMARY

REPORT NUMBER 85 - 2915

AUTHOR(S) MAJOR BUDDY B. WOOD, USAF

TITLE DESIGN OF SURVEILLANCE PLANS FOR TACTICAL MISSILES IN LONG TERM STORAGE

I. <u>Purpose</u>: To improve the pre-storage and surveillance test programs associated with tactical missile systems.

II. <u>Background</u>: Following factory production and check-out, modern tactical missiles are shipped directly to tactical units where they are stored for extended periods of time as a part of our war reserve material. Both a pre-storage test and a periodic surveillance test are typically performed using automated test equipment (ATE) to keep the reliability of the inventory above some threshold. Design of ATE to accurately check the missile electronics continues to progress, but 100 percent accuracy is an elusive goal. As a result, two types of diagnostic errors can occur: (1) alpha error, or diagnosing a good missile as bad and (2) beta error, or diagnosing a bad missile as good. These diagnostic errors, when coupled with the handling damage as a direct result of testing, can greatly diminish the effectiveness of testing if not properly accounted for in design of the missile maintenance support system.

CONTINUED

III. Analysis: Simple analytical models of both pre-storage testing and surveillance testing were developed to study the relationships among diagnostic errors, handling damage and inventory reliability. For pre-storage testing, tables were produced to identify values of alpha and beta error probabilities which will provide a desired initial missile inventory reliability. Initial production reliability, test damage probability and the desired initial inventory reliability are the required inputs for use of the tables. For surveillance testing, tables were produced to identify the sample surveillance proportion required to keep inventory reliability above some threshold value. The following inputs are required for use of the tables: production reliability, test damage probability, missile average life, both alpha and beta error probabilities, and the desired minimum inventory reliability after ten years of storage. Tables are designed for easy use by missile managers and maintenance personnel.

IV. Conclusions: Simple analytical models provide valuable insight into the effects of various parameters on missile inventory reliability. The output of the pre-storage model allows the user to specify error probabilities which are appropriate for the ATE hardware to be used for any particular system. On the other hand, the output of the surveillance model can be used to determine the level of maintenance manpower required to support the surveillance program. Thus both hardware and manpower requirements can be identified up front for effective logistics support of the missile system.

V. Recommendations: Recommendations are offered to the operational, development, and support communities. The missile maintenance community should use the surveillance model as a tool for designing their surveillance programs for existing missile systems. The development community should use the pre-storage model to determine requirements for ATE specifications of future missile systems. And the logistics support community should employ the surveillance model to develop surveillance program plans for future missile systems. The result should be missile support systems which are better defined, better designed, and more effectively executed.

Chapter One

INTRODUCTION AND BACKGROUND

THE TACTICAL MISSILE LIFE PROFILE

The tactical missile systems of today have become very sophisticated technologically and are required to survive a variety of complex environmental conditions prior to actual use by the services (7:339). Figure 1 is a typical operational life, or mission profile, for such missile systems and will be used as a baseline for the purposes of this report (10:181, 14:511). Current missiles which follow this profile at least to some degree are listed in Table 1 (12:27-29). While all missiles vary from this simplified profile, the baseline will be assumed to be correct for the typical missile.

Missiles are produced and tested at the factory or contractor's facility. Following this test, the missiles are packed in specially designed containers and shipped via rail, truck, or air to the appropriate tactical unit for use as war reserve material. Here the users place the missiles in long term storage where they are not to be used for any purposes other than war itself. During wartime the missiles are removed from storage and transported to the user for operational deployment. Although each portion of the mission profile poses some unique environmental problems for the missile and some real challenges for missile managers, <u>it is the storage portion of the profile which is of particular interest in this report</u>.

LONG TERM STORAGE

While some missiles are used for live firing programs and others are used in various tactical training exercises, the majority of the missiles are placed in long term storage as

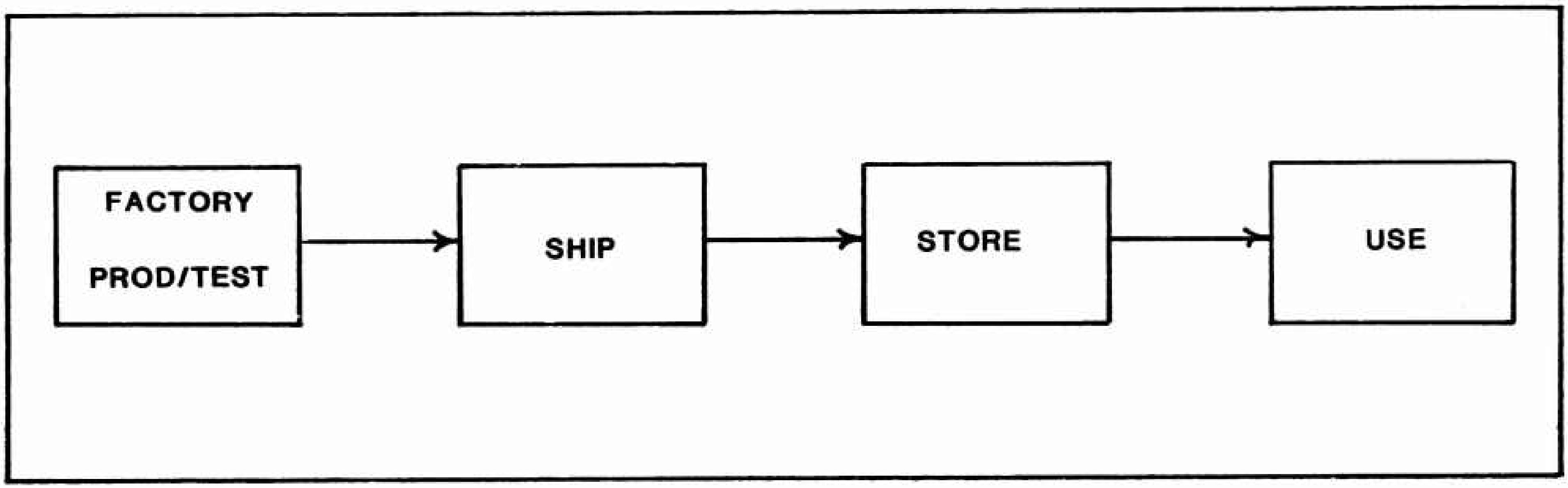

FIGURE 1: SIMPLIFIED MISSION PROFILE

Missile Category	Missile	Designation
Air-to-Air	Super Falcon	Aim-4F/G
	Phoenix	Aim-54A
	Sidewinder	Aim-9G/H/J/L/M/N/P
	Sparrow	Aim-7F
	AMRAAM	Aim-120A
Anti-Armor	Dragon	FGM-77A/FTM-77A
	TOW	BGM-71
Surface-to-Air	Redeye	FIM-43
	Stinger	FIM-92A
	Sea Sparrow	RIM-7H/M
	Standard	RIM-66A/B/67A/B
Air-to-Surface	Shrike	AGM-454
	Maverick	AGM-65
	Standard Arm	AGM-78
	HARM	AGM-88A
	Hellfire	AGM-114A
	ALCM	AGM-86
	SRAM	AGM-69
Anti-Ship	Harpoon	AGM-84A/RGM-84A
	Tomahawk	BGM-109B

TABLE 1: MISSILES FOLLOWING TYPICAL PROFILE

war reserve material (16:--). Here the missiles sit electrically dormant in their hermetically sealed containers inside large underground bunkers for maximum protection from the environment. Even under these relatively benign conditions, many serious failure mechanisms are at work within the missiles (8:168-171). As a result, a portion of the war reserve material will not be operable when called upon during wartime. Missile maintenance squadrons are addressing this problem by instituting several tests to closely monitor the stored missile inventory (7:339).

STORAGE TESTS

There are two tests used to track missiles which go into storage: a pre-storage test and a surveillance test. The pre-storage test is performed immediately before the missiles are placed into storage. This is a logical attempt to make sure the inventory is "good" initially. Missiles which fail this test are returned to the repair facility, usually located at the contractor's production plant.

The second test is the surveillance test. This is a periodic test in which the missiles are removed from storage, tested, and returned to storage. Failed missiles are returned to the repair facility. Since as many as ten thousand missiles of any given type may be tested as frequently as once every six months, the surveillance test imposes a sizeable workload on the munitions maintenance personnel. Nonetheless, surveillance is viewed as essential by the operational community in order to "keep tabs" on the state of the missile inventory (7:339).

Both the pre-storage test and the surveillance test are performed using automated test equipment (ATE). This is a computerized test set which generates a sequence of electrical commands to check the response of the missile. The electrical response from the missile is measured against predetermined thresholds to determine whether or not the missile is operable (9:182, 11:352).

TEST DIAGNOSTIC ERRORS

The result of an ATE test is essentially a red or green light indicating the ATE's assessment of missile status. Since the test is less than perfect, some missiles which are

actually good will fail the ATE test (red light indicated). This is called a Type I diagnostic error, or alpha error. In these cases good missiles will be labelled bad and will be returned to the repair facility. On the other hand, some missiles which are actually bad will pass the ATE test (green light indicated). This is called a Type II diagnostic error, or beta error. In these cases bad missiles will be labelled good and will be returned to the storage inventory. For an excellent discussion of test diagnostic errors the reader is referred to reference (6). These diagnostic errors can very dramatically reduce the effectiveness of the test program with serious impact on the readiness of the missile population (9:180). The impact has become so pronounced that some missile manufacturers are suggesting that the services eliminate such testing altogether (13:1).

PROBLEM STATEMENT

The purpose of this report is to increase the effectiveness of both the pre-storage test and the surveillance test by using analytical models to "custom design" the test programs for each particular missile system. This is done for the pre-storage test in Chapter 2 and for the surveillance test in Chapter 3. The final chapter will note the conclusions of the study and provide recommendations for the operational, development and logistics communities.

Chapter Two

PRE-STORAGE TESTING

THE SIMPLE ANALYTICAL MODEL

As discussed in Chapter One, the pre-storage test is performed on each missile just prior to entering the missile into storage. The ATE is used to perform the test, with alpha and beta diagnostic errors occuring as a result of testing. Missiles thought to be bad are sent to the repair facility, and missiles thought to be good are placed into storage. Figure 2 is an attempt to depict the pre-storage test in more detail, keeping track of both good and bad missiles throughout the testing process. Coming into the pre-storage test there are good and bad missiles as reflected in the solid and dotted lines, respectively. The variable Po will be used to represent the probability that a missile is good coming into the test. This will be referred to as production reliability. Thus the quantity 1-Po represents the probability that a missile will be bad coming into the test. These missiles are then tested where they are subjected to some chance of damage (d) as a direct result of the testing. This is simply damage due to mishandling of the missile and is a recognized problem in missile maintenance (4:7, 5:1). The damage probability d changes the portions of good and bad missiles as shown in Figure 2. Now the test diagnostic errors come into play.

Recall that alpha is the probability that a good missile will be mistakenly called bad and thus returned for repair. Similarly, beta is the probability that a bad missile will be called good and placed into storage. These probabilities are applied to the good and bad missile categories as shown in Figure 2. These results are a simple extension of the elementary laws of probability as found in any basic text on probability (2:18).

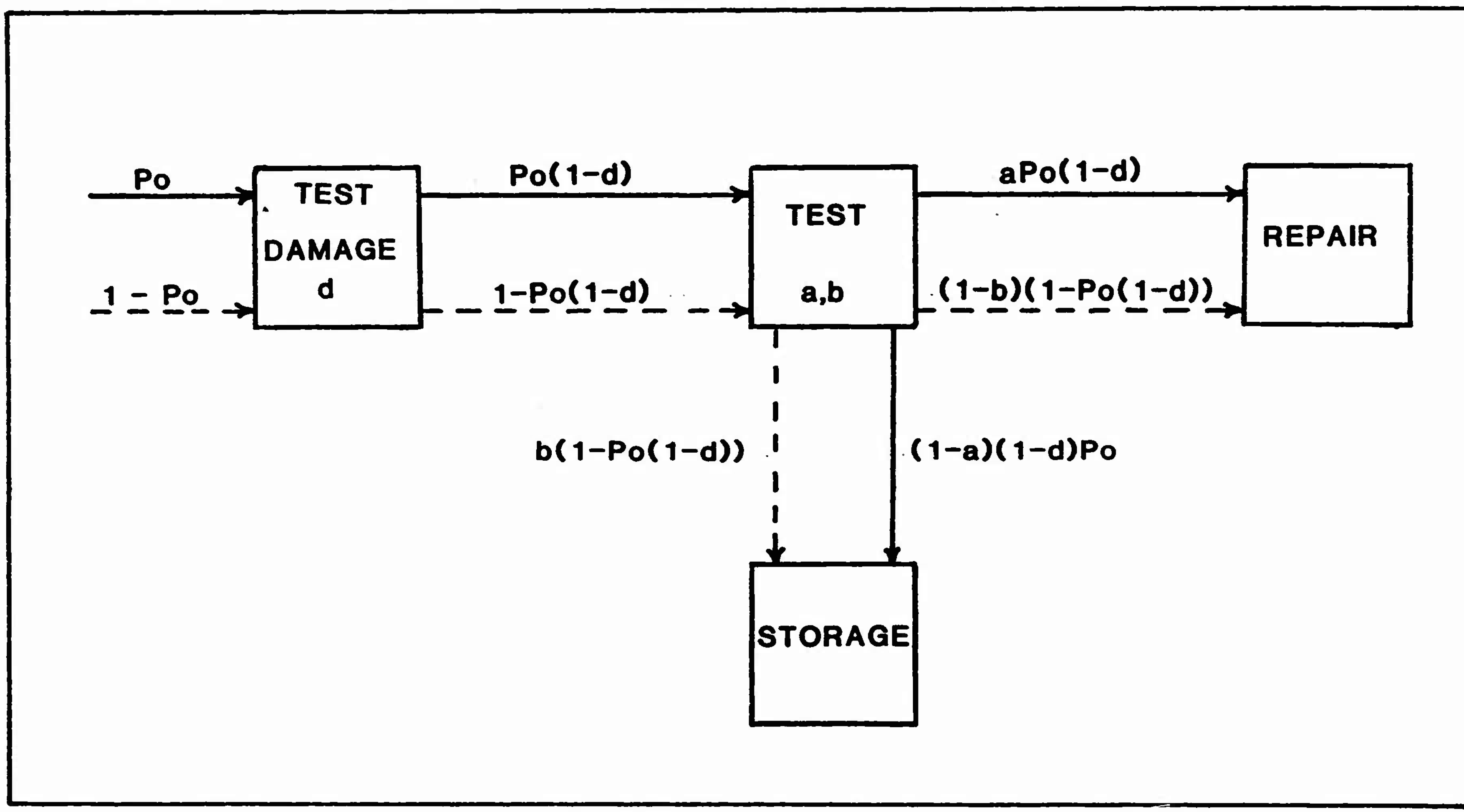

FIGURE 2: PRE-STORAGE TESTING

THE MEASURE OF EFFECTIVENESS

Of particular interest in this study are the good and bad missiles that are entering long term storage. Both the probability of a good missile going into storage and the probability of a bad missile going into storage may be taken directly from Figure 2. The initial reliability of the storage inventory may then be defined as the proportion of missiles going into storage that are good. This initial reliability will be denoted RO and is given by the following:

$$RO = \frac{Po * (1-d) * (1-alpha)}{Po * (1-d) * (1-alpha) + beta * (1 - Po * (1-d))}$$

This expression for initial inventory reliability is the measure of effectiveness that reflects the impact of testing damage and ATE diagnostic errors on the stockpile.

PROBLEM STATEMENT

From the user's standpoint the problem may be stated as follows: given a desired initial inventory reliability (RO), an anticipated test damage rate (d), and a projected production reliability (Po), what are the values for ATE alpha and beta error probabilities that will do the job? In other words, what kind of test set is needed to assure a certain reliability of the stockpile? The answer comes directly from solving the above equation for the alpha and beta pairs appropriate for given values of RO, Po and d. A simple computer routine has been written to do exactly this and is included in Appendix A. The routine has been used to produce a set of tables, which are included in Appendix B. These tables are designed for easy use by missile managers.

To use the tables in Appendix B, first identify the desired stockpile reliability. One table is produced for each single value of RO, and this value is identified in the table header. Second, identify the appropriate values for production reliability (Po) and test damage rate (d). And finally, read the calculated values of alpha and beta for the ATE. Three pairs are provided, since there are actually an infinite number of solutions to the RO expression. For example, suppose the user desires an initial inventory reliability of .97 and he expects Po = .93 with d = .05. Using the chart on page 32 the user can identify three acceptable options for ATE characteristics:

alpha = .01 and beta = .23, or
alpha = .05 and beta = .22, or
alpha = .10 and beta = .21.

MODEL LIMITATIONS

There are several limitations to this simple analytical model. First, the model is static in the sense that there is no accomodation for the build-up of the inventory over time. For example, if missiles are produced at a rate of 200 per month it will take several years to stock the inventory. This model simply assumes that all missiles are available immediately and is conservative since missiles which are delivered later will not have failed in storage.

A second limitation is that apparently no account has been made of the missiles which are returned for repair. Missiles which are returned for repair, however, eventually come back through the system in the same ratios as the original group: thus initial inventory reliability would not be affected.

A third limitation is that the measure of effectiveness (RO) deals only with the ratio of good missiles rather than with the number of good missiles in storage. Thus the inventory could be ninety percent reliable with only ten missiles in storage - an inadequate number to support the surge of wartime operations. Other logistics measures would be more appropriate to study ways to increase the number of good missiles in storage.

A fourth limitation is that the model ignores sampling error by using statistical expectation for all calculations. For example, the model assumes that a true average test damage factor of five percent would result in exactly five percent defective on any given test. In reality the number of missiles damaged would be a random variable which follows the binomial distribution (2:252). For large quantities of missiles the error inherent in this assumption is small: for 1000 missiles one is 90% sure that the actual test damage differs from the true average by less than 1.1 percent (2:253).

In spite of these four limitations, the simple analytical model is an effective tool for improving pre-storage testing schemes. The user can now quite literally specify two very important ATE characteristics based upon their impact on inventory reliability.

Chapter Three

SURVEILLANCE TESTING

THE SIMPLE ANALYTICAL MODEL

As discussed in Chapter One, the surveillance test is a periodic test in which missiles are removed from storage and tested using ATE. Missiles testing good are returned to storage and missiles testing bad are sent to the repair facility. Surveillance has two purposes: (1) to estimate the inventory reliability, i.e. the proportion of the inventory which is "good" and (2) to upgrade the inventory by repairing the missiles which are found to be "bad" (15:--). Figure 3 depicts the surveillance test in more detail, once again using solid and dotted lines to track good and bad missiles as they go through the process. The variable R(0) is used to represent the initial inventory reliability: R(0) is the output of the pre-storage test program and the input to the surveillance test. Table 2 includes a brief description of the events in Figure 3.

First the missiles are placed in storage and remain there undisturbed for some length of time t, in hours. If the missiles have an average life m, the proportion of missiles failing in t hours can be calculated using the exponential probability distribution function as follows:

$$F(t) = 1 - \exp(-t / m).$$

The proportion of missiles surviving t hours is the complement of F(t), or $p=\exp(-t/m)$ (3:159). The exponential model has been widely used for electronic components and has been applied to missiles in storage by the Warner Robbins Air Logistics Center (17:--).

After remaining in storage for t hours, a portion of the inventory is removed for testing. The variable s is used to represent this proportion. For example, s=.10 implies that every t hours, ten percent of the missile inventory is withdrawn from storage for testing. Under a random sampling

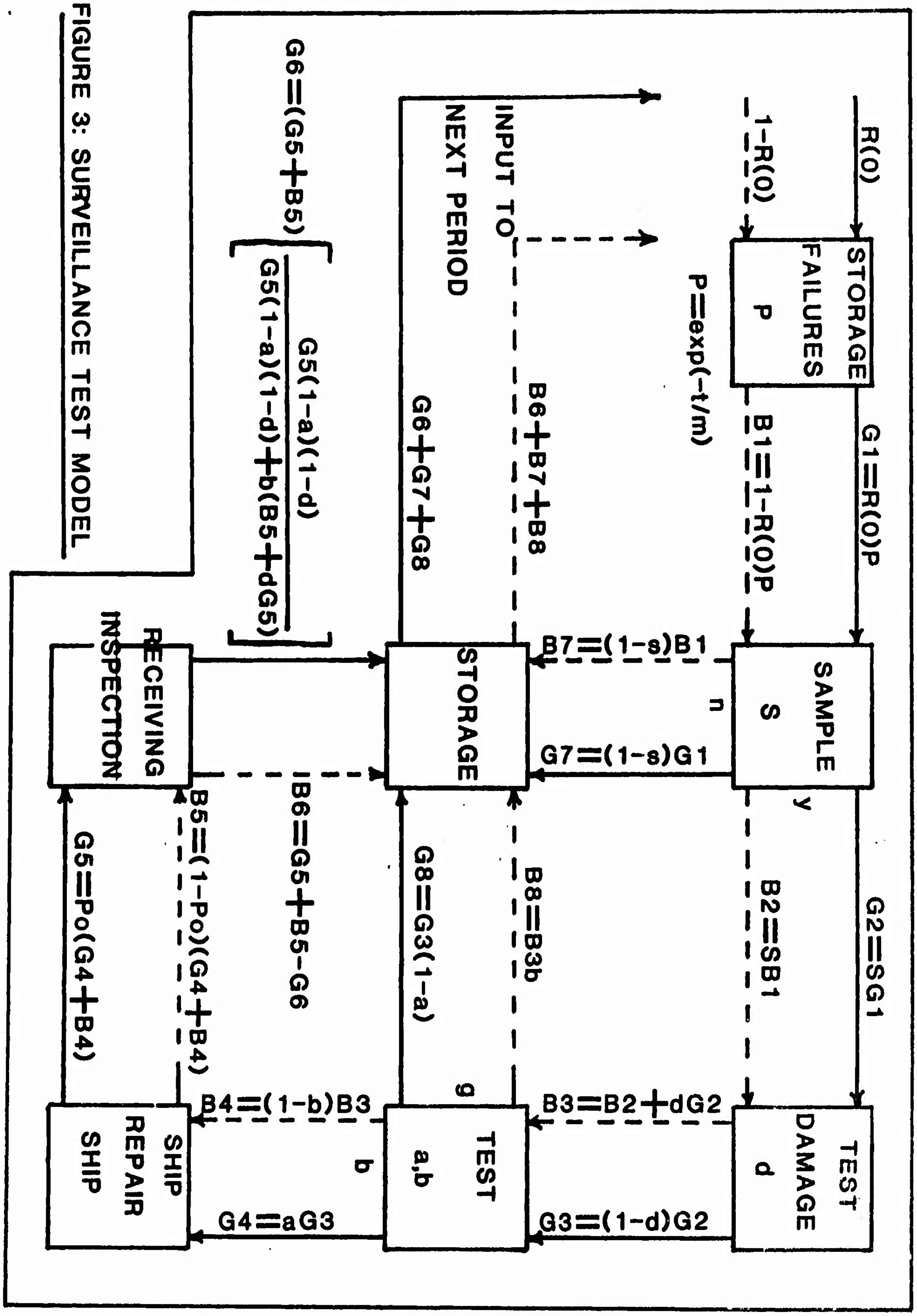

FIGURE 3: SURVEILLANCE TEST MODEL

EVENT	DISCUSSION
1	Missiles fail in storage. For a storage period of length t with missiles of average life m, the probability of failure is 1-exp(-t/m). The exponential probability density function has been assumed for this result.
2	Missiles are drawn out of storage as a part of the surveillance sample. The sample proportion is s.
3	Test damage results from handling with probability d.
4	Both good and bad missiles tested using ATE will test bad. Good missiles test bad with probability alpha, and bad missiles test bad with probability (1-beta).
5	Missiles testing bad are shipped to the repair facility, repaired, and shipped back to the tactical unit. The proportion of these that are good upon arrival at the tactical unit is Po (refer to Chapter 2).
6	Receiving inspection is performed on missiles which have been repaired. This is similar to the pre-storage test model as described in Chapter 2. The receiving inspection model is shown in Figure 4.
7	Some missiles are not selected as a part of the surveillance program. This proportion is 1-s.
8	Both good and bad missiles tested using ATE will test good and are returned to storage. Good missiles will test good with probability (1-alpha). Bad missiles will test good with probability beta.

TABLE 2: Definition of Events for Surveillance Model

scheme, one would expect ten percent of the good missiles to be drawn and ten percent of the bad missiles to be drawn. This expectation is shown in Figure 3 for events 2 and 7.

At this point the test damage proportion d is applied to the missiles which are to be tested. As mentioned in Chapter 2, the infliction of damage as a direct result of testing is a reality when thousands of missiles are handled by maintenance personnel.

Next the missiles are tested using the ATE. Remember that alpha and beta diagnostic errors occur, causing both good missiles to be returned for repair and bad missiles to go back into storage. The resulting proportions of good and bad missiles are shown in Figure 3 for events 4 and 8.

Events 5 and 6 are shown for the missiles which are shipped to the repair facility, repaired, shipped back to the tactical unit, and exposed to a receiving inspection. This receiving inspection is equivalent to the pre-storage test which was modelled in Chapter 2. Application of this same model to the receiving inspection is shown in Figure 4.

After the above sequence of events is complete, there are three categories of good and bad missiles in storage: (1) missiles not selected for testing, (2) missiles passing the surveillance test, and (3) missiles failing the surveillance test but returned to storage after repair. All three categories of missiles are then exposed to another t hours of undisturbed storage, and the cycle is repeated. This is represented by the feedback loop in Figure 3.

THE MEASURE OF EFFECTIVENESS

As the inventory cycles from one storage period to the next, the inventory reliability continues to decrease. The rate of decrease is a function of the missile average life m, the length of the storage period t, the sample proportion s, the test damage rate d, the initial production reliability Po, and the ATE parameters alpha and beta. Missile managers are particularly interested in designing a surveillance program to keep inventory reliability from dropping below some minimum acceptable level, say RM. With the variable RM as the measure of effectiveness, then, the question becomes what sample proportion s will keep reliability at or above RM? The analytical model depicted in Figure 3 may be used to answer this question for given values of Po, d, t, m, alpha and beta.

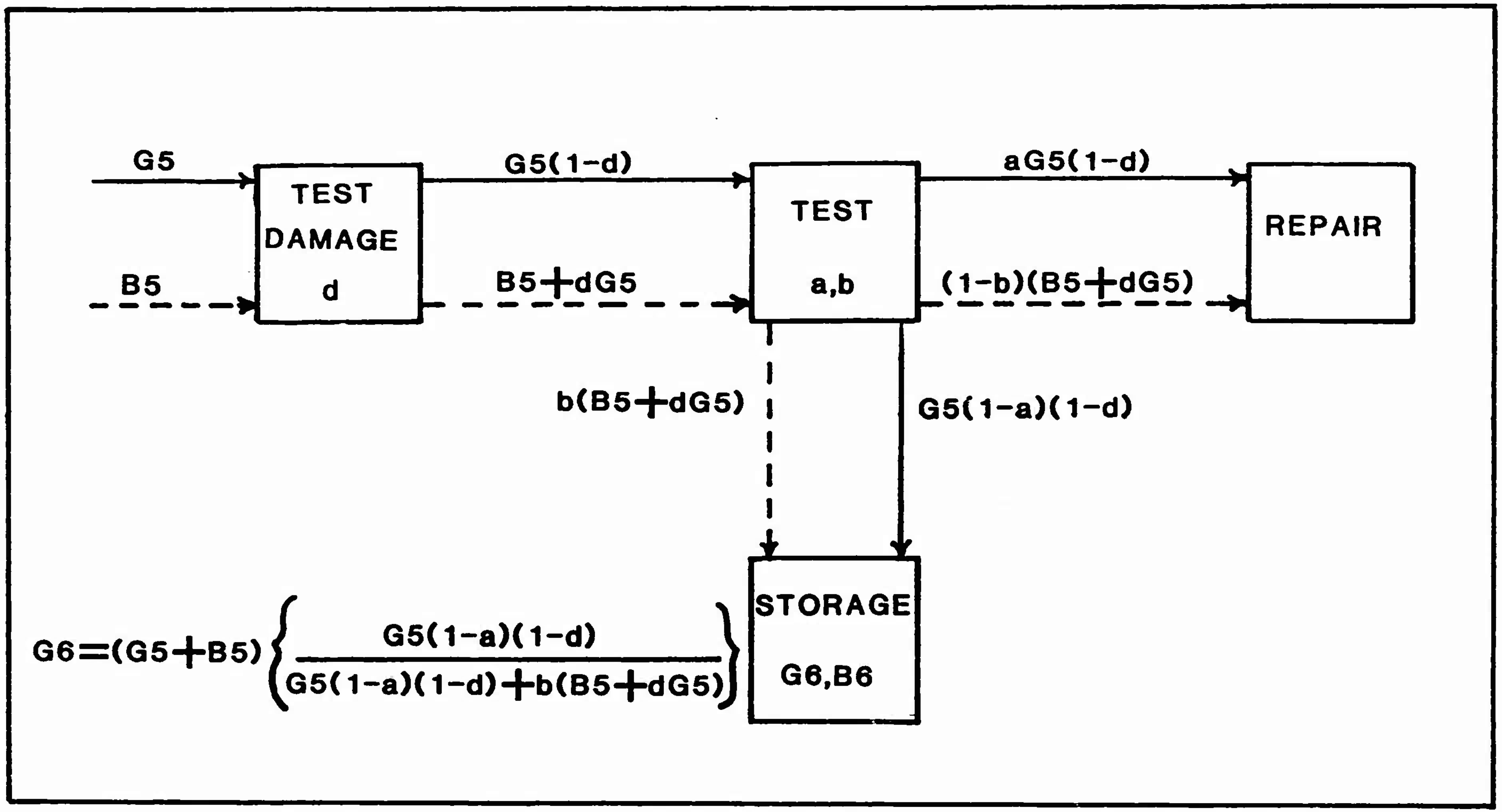

FIGURE 4: SURVEILLANCE RECEIVING INSPECTION

MODEL APPLICATION

One can assume a value for the variable s and then track both good and bad missiles through the iterative sequence of events in Figure 3. The result will be some minimum reliability for that particular s, and for the given values of Po, t, m, d, alpha and beta. If RM is too low, the value of s can be increased until the desired RM is maintained. A computer routine has been written to do this on the TRS-80 Model III computer and is included in Appendix C. The routine uses the classic bisection algorithm to search for the value of s that will yield a desired RM (1:23). The results of many executions of the model are tabularized in Appendix D.

USE OF TABLES

The tables in Appendix D have been accomplished for all combinations of the following sets of data:

Po = .95 or .98
d = 0, .05 or .10
alpha = .01 or .05
beta = .05 to .50 in increments of .05
m = 50000, 100000, 200000, 300000 or 400000
RM = .70,.75,.80,.85,.90,.95,.97 or .99

The value of variable t has been set to 8760 hours, which implies yearly surveillance in all cases. Ten cycles in the storage loop (ten years of storage) have also been assumed for all calculations. These values are believed to cover the "range of reality" for current and proposed missile systems.

To use the tables the user simply identifies the values of the input variables, identifies the desired minimum inventory reliability after ten years, and then reads from the appropriate table the surveillance sample proportion necessary to produce the desired reliability. For example, suppose the user suspects a production reliability of .95, a missile average life of 200000 hours, a test damage rate of .05, and has a test set with parameters alpha=.01 and beta=.20. The table on page 41 has been constructed for these inputs. To assure a minimum ten year reliability of .80, munitions maintenance personnel must sample and test 16.4% of the inventory each year. Furthermore, to boost the reliability to 90 percent would require a sample of 38.5% of the inventory each year. With these results readily available to missile

managers, trade-offs are now possible between the cost of surveillance (required sample proportion) and the payoff of surveillance (increased inventory reliability). Note that if an inventory reliability of .99 were desired, no yearly sample would suffice. This is indicated by the dashed lines in the table. In these cases, the time period t between samples must be shortened, increasing the maintenance workload.

LIMITATIONS OF THE SURVEILLANCE MODEL

There are several limitations to this simple model of surveillance. First, the model contains the four limitations of the pre-storage testing model, since the pre-storage testing model is used as a part of the surveillance model (refer to Figures 3 and 4). These limitations were addressed in Chapter 2 and will not be repeated here.

A second limitation is that logistics pipeline times for repaired items have been ignored. The assumption is that pipeline time is "short" compared to the time between tests (t), and thus all reparables make it back into storage before the next test cycle. This assumption is reasonable since depots are allowed 90 days to turnaround missiles, while the typical test cycle is one year.

A third limitation is that time to accomplish the actual testing has been ignored. Again the assumption is that test time is short relative to the time between tests, so that sufficient time is available to get all required testing done. While this assumption is reasonable for relatively small sample sizes, large sample sizes could impose such a large maintenance workload that testing from one cycle could not be completed before testing were required for the next cycle. This poses a real maintenance manning problem which is typical of compensating for a poorly designed system with excessive maintenance manpower.

In spite of these limitations, the surveillance model provides a rational basis for design of surveillance programs. Using the tables in Appendix D, missiles managers are now able to "custom design" surveillance programs to match the characteristics of each different missile system.

Chapter Four

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Simple analytical models of both pre-storage testing and surveillance testing have been developed to improve the efficiency of maintaining large inventories of tactical missile systems. The pre-storage model allows the user to specify test set diagnostic error probabilities which make pre-storage testing beneficial in terms of initial inventory reliability. Thus the output of this model relates to the hardware involved in the maintenance support system. The surveillance model, on the other hand, allows the user to determine what sample surveillance proportion is appropriate for a desired ten-year storage reliability. The output of the surveillance model relates to the maintenance manpower requirements for supporting the missile hardware. Use of both models should, therefore, improve the total support system.

RECOMMENDATIONS

There are three recommendations. First, the missile maintenance community should consider use of the surveillance model to design surveillance test programs for existing missile systems. While the surveillance model is not purported to be the only way to approach the problem, at least it is one way to rationally address the problem. A simple modelling approach has been taken, and the results are easy to use.

Second, the development community should consider use of the pre-storage model in determining quantitative requirements for the ATE specifications of future missile systems. By relating diagnostic error probabilities to storage

reliability, test equipment specifications can be written which relate directly to the needs of the operating and maintenance communities.

Finally, the logistics community should consider use of the surveillance model in developing surveillance program plans for future missile systems. Requirements for surveillance can now be related to inventory reliability and hence operational effectiveness: the result should be more missiles on target per missile maintenance manhour, and that is the name of the game in integrated logistics support.

BIBLIOGRAPHY

A. REFERENCES CITED

Books

1. Burden, Richard L., J. Douglas Faires and Albert C. Reynolds. Numerical Analysis. Boston, Mass: Prindle, Weber & Schmidt, 1978.

2. Hines, William W. and Douglas C. Montgomery. Probability and Statistics In Engineering and Management Science, New York: John Wiley & Sons 1980.

3. Kapur, K.C. and L.R. Lamberson. Reliability In Engineering Design. New York: John Wiley & Sons 1977.

Articles and Periodicals

4. Axell, C.L. "Missile Handling Damage," Mechanics, Fall 1979, p. 7.

5. Biddle, Wayne. "Missiles Found Useless," The New York Times, 19 September 1984, p.1.

6. Gleason, Daniel. "Analysis of Built-in-Test Accuracy," Proceedings of the Annual Reliability and Maintainability Symposium, January 1982, pp. 370-377.

7. Holbrook, R. Owen. "Built-In Test Improves Expendable Weapon Readiness," Proceedings of the Annual Reliability and Maintainability Symposium, January 1983, pp. 339-343.

8. Kasouf, George and David A. McGoye. "R/M Design For Long Term Storage," Proceedings of the Annual Reliability and Maintainability Symposium, January 1984, pp. 168-175.

CONTINUED

9. Malcolm, J.G. "Practical Application of Bayes Formula," Proceedings of the Annual Reliability and Maintainability Symposium, January 1983, pp. 180-186.

10. Martinez, Eugene C. "Storage Reliability With Periodic Test," Proceedings of the Annual Reliability and Maintainability Symposium, January 1984, pp. 181-185.

11. Meth, Martin A. and Thomas A. Musson. "Finding Faults-A Dilemma For Statisticians," Proceedings of the Annual Reliability and Maintainability Symposium January 1983, pp. 351-355.

12. "The Missile Tables," <u>Defense & Foreign Affairs</u>, March 1984, pp. 26-30.

13. Stansbery, Robert L. "Periodic Testing of Stored Missiles Might Degrade Reliability," <u>Managing For Reliability and Maintainability</u>, May 1983, pp. 1-3.

14. Wood, Buddy B. "Development of the Reliability Program for the Advanced Medium Range Air-to-Air Missile," Proceedings of the Annual Reliability and Maintainability Symposium, January 1982, pp. 510-514.

Other Sources

15. Burke, Andrew. Director of Product Assurance, AMRAAM Program Office, Eglin AFB, Florida. Telecon 4 September 1984.

16. Dewalt, James. Missile Management Specialist, Logistics Operations Center, Wright-Patterson AFB, Ohio. Telecon, 2 October 1984.

17. Warren, Donnie. Chief of Logistics Assessment, Warner Robins Air Logistics Center, Robins AFB, Georgia. Telecon, 4 September 1984.

APPENDIX

APPENDIX A

PRE-STORAGE COMPUTER PROGRAM

```
100 REM      This program models the pre-storage testing of
110 REM      tactical missiles. In particular the program
120 REM      calculates the maximum permissable value of ATE
130 REM      beta error which will make the pre-storage test
140 REM      worthwhile. Variables are defined below.
150 REM
160 REM      p0 is the portion of the missile inventory
170 REM      which is good prior to the pre-storage test
180 REM
190 REM     d is the probability of damage to the missile
200 REM     as a direct result of testing
210 REM
220 REM     a is the probability that ATE will make a
230 REM     Type I error
240 REM
250 REM     b is the probability that ATE will make a
260 REM     Type II error
270 REM
280 REM     r0 is the minimum inventory reliability desired
290 REM
300 CLS
310 INPUT"Input value for minimum inventory reliability ";R0
320 OUT 250,27:OUT 250,87:OUT 250,1
330 LPRINT
340 LPRINT
350 LPRINT"     TEST EQUIPMENT CHARACTERISTICS"
360 LPRINT
370 LPRINT"                    FOR"
380 LPRINT
390 LPRINT"          PRE-STORAGE TESTING"
400 OUT 250,27:OUT 250,87:OUT 250,0
410 LPRINT
420 LPRINT
430  LPRINT "            Values  shown  are ATE alpha  and  beta
error probabilities"
440 LPRINT
450 LPRINT "            which  will give  an initial  inventory
reliability of";R0
460                              LPRINT                           "
----------------------------------------------------"
470 LPRINT
480 LPRINT
490 LPRINT"            D = .01  D = .02  D  = .03   D = .04  D
= .05  D = .06  D = .07"
500  LPRINT"              =======  =======  =======  =======
=======  =======  ======="
510 LPRINT
520 A$="     P0=.##  "
530 B$=".##,.##  "
540 A(1)=.01:A(2)=.05:A(3)=.10
550 CMD"route do do pr"
```

```
560 FOR PO=.9 TO .99 STEP .01
570 PRINT USING A$;PO;
580 FOR I= 1 TO 3
590 A=A(I)
600 FOR D=.01 TO .07 STEP .01
610 B=PO*(1-D)*(1-A)/RO-PO*(1-D)*(1-A)
620 B=B/(1-PO*(1-D))
630 IF B>=.99 THEN B=.99
640 IF D=.01 THEN IF A<>.01 THEN PRINT"                    ";
650 PRINT USING B$;A,B;
660 NEXT D
670 PRINT
680 NEXT I
690 PRINT
700 NEXT PO
710 CMD"route clear"
```

APPENDIX

APPENDIX B

TABLES FOR PRE-STORAGE TESTING

TEST EQUIPMENT CHARACTERISTICS

FOR

PRE-STORAGE TESTING

Values shown are ATE alpha and beta error probabilities

which will give an initial inventory reliability of .9

	D = .01	D = .02	D = .03	D = .04	D = .05	D = .06	D = .07
PO=.90	.01,.90	.01,.82	.01,.76	.01,.70	.01,.65	.01,.60	.01,.56
	.05,.86	.05,.79	.05,.73	.05,.67	.05,.62	.05,.58	.05,.54
	.10,.82	.10,.75	.10,.69	.10,.64	.10,.59	.10,.55	.10,.51
PO=.91	.01,.99	.01,.91	.01,.83	.01,.76	.01,.70	.01,.65	.01,.61
	.05,.96	.05,.87	.05,.79	.05,.73	.05,.67	.05,.62	.05,.58
	.10,.91	.10,.82	.10,.75	.10,.69	.10,.64	.10,.59	.10,.55
PO=.92	.01,.99	.01,.99	.01,.91	.01,.83	.01,.76	.01,.70	.01,.65
	.05,.99	.05,.97	.05,.88	.05,.80	.05,.73	.05,.68	.05,.63
	.10,.99	.10,.92	.10,.83	.10,.76	.10,.69	.10,.64	.10,.59
PO=.93	.01,.99	.01,.99	.01,.99	.01,.92	.01,.83	.01,.76	.01,.70
	.05,.99	.05,.99	.05,.97	.05,.88	.05,.80	.05,.73	.05,.68
	.10,.99	.10,.99	.10,.92	.10,.83	.10,.76	.10,.69	.10,.64
PO=.94	.01,.99	.01,.99	.01,.99	.01,.99	.01,.92	.01,.84	.01,.76
	.05,.99	.05,.99	.05,.99	.05,.98	.05,.88	.05,.80	.05,.73
	.10,.99	.10,.99	.10,.99	.10,.92	.10,.83	.10,.76	.10,.69
PO=.95	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.92	.01,.83
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.98	.05,.88	.05,.80
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.93	.10,.83	.10,.76
PO=.96	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.92
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.98	.05,.88
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.92	.10,.83
PO=.97	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.97
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.92
PO=.98	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99
PO=.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99

TEST EQUIPMENT CHARACTERISTICS

FOR

PRE-STORAGE TESTING

Values shown are ATE alpha and beta error probabilities

which will give an <u>initial inventory reliability of .91</u>

	D = .01	D = .02	D = .03	D = .04	D = .05	D = .06	D = .07
PO=.90	.01,.80	.01,.73	.01,.67	.01,.62	.01,.58	.01,.54	.01,.50
	.05,.77	.05,.70	.05,.65	.05,.60	.05,.55	.05,.52	.05,.48
	.10,.73	.10,.67	.10,.61	.10,.57	.10,.52	.10,.49	.10,.46
PO=.91	.01,.89	.01,.81	.01,.74	.01,.68	.01,.62	.01,.58	.01,.54
	.05,.85	.05,.77	.05,.71	.05,.65	.05,.60	.05,.56	.05,.52
	.10,.81	.10,.73	.10,.67	.10,.62	.10,.57	.10,.53	.10,.49
PO=.92	.01,.99	.01,.90	.01,.81	.01,.74	.01,.68	.01,.63	.01,.58
	.05,.96	.05,.86	.05,.78	.05,.71	.05,.65	.05,.60	.05,.56
	.10,.91	.10,.82	.10,.74	.10,.67	.10,.62	.10,.57	.10,.53
PO=.93	.01,.99	.01,.99	.01,.90	.01,.82	.01,.74	.01,.68	.01,.63
	.05,.99	.05,.97	.05,.87	.05,.78	.05,.71	.05,.65	.05,.60
	.10,.99	.10,.92	.10,.82	.10,.74	.10,.68	.10,.62	.10,.57
PO=.94	.01,.99	.01,.99	.01,.99	.01,.91	.01,.82	.01,.74	.01,.68
	.05,.99	.05,.99	.05,.97	.05,.87	.05,.78	.05,.71	.05,.65
	.10,.99	.10,.99	.10,.92	.10,.82	.10,.74	.10,.68	.10,.62
PO=.95	.01,.99	.01,.99	.01,.99	.01,.99	.01,.91	.01,.82	.01,.74
	.05,.99	.05,.99	.05,.99	.05,.97	.05,.87	.05,.78	.05,.71
	.10,.99	.10,.99	.10,.99	.10,.92	.10,.82	.10,.74	.10,.68
PO=.96	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.91	.01,.82
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.97	.05,.87	.05,.78
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.92	.10,.82	.10,.74
PO=.97	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.90
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.97	.05,.87
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.92	.10,.82
PO=.98	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.97
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.92
PO=.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99

TEST EQUIPMENT CHARACTERISTICS

FOR

PRE-STORAGE TESTING

Values shown are ATE alpha and beta error probabilities

which will give an initial inventory reliability of .92

	D = .01	D = .02	D = .03	D = .04	D = .05	D = .06	D = .07
PO=.90	.01,.70	.01,.64	.01,.59	.01,.55	.01,.51	.01,.47	.01,.44
	.05,.68	.05,.62	.05,.57	.05,.52	.05,.49	.05,.45	.05,.42
	.10,.64	.10,.58	.10,.54	.10,.50	.10,.46	.10,.43	.10,.40
PO=.91	.01,.78	.01,.71	.01,.65	.01,.59	.01,.55	.01,.51	.01,.47
	.05,.75	.05,.68	.05,.62	.05,.57	.05,.53	.05,.49	.05,.45
	.10,.71	.10,.65	.10,.59	.10,.54	.10,.50	.10,.46	.10,.43
PO=.92	.01,.88	.01,.79	.01,.71	.01,.65	.01,.60	.01,.55	.01,.51
	.05,.84	.05,.76	.05,.69	.05,.62	.05,.57	.05,.53	.05,.49
	.10,.80	.10,.72	.10,.65	.10,.59	.10,.54	.10,.50	.10,.46
PO=.93	.01,.99	.01,.89	.01,.79	.01,.72	.01,.65	.01,.60	.01,.55
	.05,.96	.05,.85	.05,.76	.05,.69	.05,.63	.05,.57	.05,.53
	.10,.91	.10,.81	.10,.72	.10,.65	.10,.59	.10,.54	.10,.50
PO=.94	.01,.99	.01,.99	.01,.89	.01,.80	.01,.72	.01,.65	.01,.60
	.05,.99	.05,.97	.05,.85	.05,.76	.05,.69	.05,.63	.05,.57
	.10,.99	.10,.91	.10,.81	.10,.72	.10,.65	.10,.59	.10,.54
PO=.95	.01,.99	.01,.99	.01,.99	.01,.89	.01,.80	.01,.72	.01,.65
	.05,.99	.05,.99	.05,.97	.05,.86	.05,.76	.05,.69	.05,.63
	.10,.99	.10,.99	.10,.92	.10,.81	.10,.72	.10,.65	.10,.59
PO=.96	.01,.99	.01,.99	.01,.99	.01,.99	.01,.89	.01,.80	.01,.72
	.05,.99	.05,.99	.05,.99	.05,.97	.05,.86	.05,.76	.05,.69
	.10,.99	.10,.99	.10,.99	.10,.92	.10,.81	.10,.72	.10,.65
PO=.97	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.89	.01,.79
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.97	.05,.85	.05,.76
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.92	.10,.81	.10,.72
PO=.98	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.89
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.97	.05,.85
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.91	.10,.81
PO=.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.96
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.91

TEST EQUIPMENT CHARACTERISTICS

FOR

PRE-STORAGE TESTING

Values shown are ATE alpha and beta error probabilities

which will give an initial inventory reliability of .93

	D = .01	D = .02	D = .03	D = .04	D = .05	D = .06	D = .07
PO=.90	.01,.61	.01,.56	.01,.51	.01,.47	.01,.44	.01,.41	.01,.38
	.05,.58	.05,.53	.05,.49	.05,.45	.05,.42	.05,.39	.05,.37
	.10,.55	.10,.51	.10,.47	.10,.43	.10,.40	.10,.37	.10,.35
PO=.91	.01,.68	.01,.61	.01,.56	.01,.52	.01,.48	.01,.44	.01,.41
	.05,.65	.05,.59	.05,.54	.05,.49	.05,.46	.05,.42	.05,.39
	.10,.62	.10,.56	.10,.51	.10,.47	.10,.43	.10,.40	.10,.37
PO=.92	.01,.76	.01,.68	.01,.62	.01,.56	.01,.52	.01,.48	.01,.44
	.05,.73	.05,.66	.05,.59	.05,.54	.05,.50	.05,.46	.05,.42
	.10,.69	.10,.62	.10,.56	.10,.51	.10,.47	.10,.43	.10,.40
PO=.93	.01,.87	.01,.77	.01,.69	.01,.62	.01,.57	.01,.52	.01,.48
	.05,.83	.05,.74	.05,.66	.05,.60	.05,.54	.05,.50	.05,.46
	.10,.79	.10,.70	.10,.62	.10,.56	.10,.51	.10,.47	.10,.43
PO=.94	.01,.99	.01,.87	.01,.77	.01,.69	.01,.62	.01,.57	.01,.52
	.05,.96	.05,.84	.05,.74	.05,.66	.05,.60	.05,.54	.05,.50
	.10,.91	.10,.79	.10,.70	.10,.63	.10,.57	.10,.51	.10,.47
PO=.95	.01,.99	.01,.99	.01,.87	.01,.77	.01,.69	.01,.62	.01,.57
	.05,.99	.05,.96	.05,.84	.05,.74	.05,.66	.05,.60	.05,.54
	.10,.99	.10,.91	.10,.80	.10,.70	.10,.63	.10,.57	.10,.51
PO=.96	.01,.99	.01,.99	.01,.99	.01,.88	.01,.77	.01,.69	.01,.62
	.05,.99	.05,.99	.05,.97	.05,.84	.05,.74	.05,.66	.05,.60
	.10,.99	.10,.99	.10,.92	.10,.80	.10,.70	.10,.63	.10,.56
PO=.97	.01,.99	.01,.99	.01,.99	.01,.99	.01,.87	.01,.77	.01,.69
	.05,.99	.05,.99	.05,.99	.05,.97	.05,.84	.05,.74	.05,.66
	.10,.99	.10,.99	.10,.99	.10,.92	.10,.80	.10,.70	.10,.62
PO=.98	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.87	.01,.77
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.96	.05,.84	.05,.74
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.91	.10,.79	.10,.70
PO=.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.87
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.99	.05,.96	.05,.83
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.99	.10,.91	.10,.79

TEST EQUIPMENT CHARACTERISTICS

FOR

PRE-STORAGE TESTING

Values shown are ATE alpha and beta error probabilities

which will give an initial inventory reliability of .94

	D = .01	D = .02	D = .03	D = .04	D = .05	D = .06	D = .07
PO=.90	.01,.52	.01,.47	.01,.43	.01,.40	.01,.37	.01,.35	.01,.32
	.05,.50	.05,.45	.05,.42	.05,.39	.05,.36	.05,.33	.05,.31
	.10,.47	.10,.43	.10,.39	.10,.36	.10,.34	.10,.32	.10,.29
PO=.91	.01,.57	.01,.52	.01,.48	.01,.44	.01,.40	.01,.37	.01,.35
	.05,.55	.05,.50	.05,.46	.05,.42	.05,.39	.05,.36	.05,.33
	.10,.52	.10,.47	.10,.43	.10,.40	.10,.37	.10,.34	.10,.32
PO=.92	.01,.65	.01,.58	.01,.52	.01,.48	.01,.44	.01,.40	.01,.37
	.05,.62	.05,.56	.05,.50	.05,.46	.05,.42	.05,.39	.05,.36
	.10,.59	.10,.53	.10,.48	.10,.43	.10,.40	.10,.37	.10,.34
PO=.93	.01,.73	.01,.65	.01,.58	.01,.53	.01,.48	.01,.44	.01,.40
	.05,.70	.05,.62	.05,.56	.05,.51	.05,.46	.05,.42	.05,.39
	.10,.67	.10,.59	.10,.53	.10,.48	.10,.44	.10,.40	.10,.37
PO=.94	.01,.85	.01,.74	.01,.65	.01,.58	.01,.53	.01,.48	.01,.44
	.05,.81	.05,.71	.05,.63	.05,.56	.05,.51	.05,.46	.05,.42
	.10,.77	.10,.67	.10,.59	.10,.53	.10,.48	.10,.44	.10,.40
PO=.95	.01,.99	.01,.85	.01,.74	.01,.65	.01,.58	.01,.53	.01,.48
	.05,.96	.05,.82	.05,.71	.05,.63	.05,.56	.05,.51	.05,.46
	.10,.91	.10,.78	.10,.67	.10,.60	.10,.53	.10,.48	.10,.44
PO=.96	.01,.99	.01,.99	.01,.86	.01,.74	.01,.65	.01,.58	.01,.53
	.05,.99	.05,.96	.05,.82	.05,.71	.05,.63	.05,.56	.05,.51
	.10,.99	.10,.91	.10,.78	.10,.68	.10,.60	.10,.53	.10,.48
PO=.97	.01,.99	.01,.99	.01,.99	.01,.86	.01,.74	.01,.65	.01,.58
	.05,.99	.05,.99	.05,.97	.05,.82	.05,.71	.05,.63	.05,.56
	.10,.99	.10,.99	.10,.91	.10,.78	.10,.67	.10,.59	.10,.53
PO=.98	.01,.99	.01,.99	.01,.99	.01,.99	.01,.85	.01,.74	.01,.65
	.05,.99	.05,.99	.05,.99	.05,.96	.05,.82	.05,.71	.05,.62
	.10,.99	.10,.99	.10,.99	.10,.91	.10,.78	.10,.67	.10,.59
PO=.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.85	.01,.73
	.05,.99	.05,.99	.05,.99	.05,.99	.05,.96	.05,.81	.05,.70
	.10,.99	.10,.99	.10,.99	.10,.99	.10,.91	.10,.77	.10,.67

TEST EQUIPMENT CHARACTERISTICS

FOR

PRE-STORAGE TESTING

Values shown are ATE alpha and beta error probabilities

which will give an <u>initial inventory reliability of .95</u>

	D = .01	D = .02	D = .03	D = .04	D = .05	D = .06	D = .07
PO=.90	.01,.43	.01,.39	.01,.36	.01,.33	.01,.31	.01,.29	.01,.27
	.05,.41	.05,.37	.05,.34	.05,.32	.05,.29	.05,.27	.05,.26
	.10,.39	.10,.35	.10,.33	.10,.30	.10,.28	.10,.26	.10,.24
PO=.91	.01,.47	.01,.43	.01,.39	.01,.36	.01,.33	.01,.31	.01 29
	.05,.45	.05,.41	.05,.38	.05,.35	.05,.32	.05,.30	.05, 28
	.10,.43	.10,.39	.10,.36	.10,.33	.10,.30	.10,.28	.10,.26
PO=.92	.01,.53	.01,.48	.01,.43	.01,.39	.01,.36	.01,.33	.01,.31
	.05,.51	.05,.46	.05,.41	.05,.38	.05,.35	.05,.32	.05,.30
	.10,.48	.10,.43	.10,.39	.10,.36	.10,.33	.10,.30	.10,.28
PO=.93	.01,.60	.01,.54	.01,.48	.01,.43	.01,.40	.01,.36	.01,.33
	.05,.58	.05,.51	.05,.46	.05,.42	.05,.38	.05,.35	.05,.32
	.10,.55	.10,.49	.10,.44	.10,.39	.10,.36	.10,.33	.10,.30
PO=.94	.01,.70	.01,.61	.01,.54	.01,.48	.01,.43	.01,.40	.01,.36
	.05,.67	.05,.58	.05,.52	.05,.46	.05,.42	.05,.38	.05,.35
	.10,.64	.10,.55	.10,.49	.10,.44	.10,.40	.10,.36	.10,.33
PO=.95	.01,.82	.01,.70	.01,.61	.01,.54	.01,.48	.01,.43	.01,.40
	.05,.79	.05,.67	.05,.59	.05,.52	.05,.46	.05,.42	.05,.38
	.10,.75	.10,.64	.10,.56	.10,.49	.10,.44	.10,.40	.10,.36
PO=.96	.01,.99	.01,.83	.01,.71	.01,.61	.01,.54	.01,.48	.01,.43
	.05,.96	.05,.79	.05,.68	.05,.59	.05,.52	.05,.46	.05,.42
	.10,.91	.10,.75	.10,.64	.10,.[illegible]	.10,.49	.10,.44	.10,.39
PO=.97	.01,.99	.01,.99	.01,.83	.01,.71	.01,.61	.01,.54	.01,.48
	.05,.99	.05,.96	.05,.80	.05,.68	.05,.59	.05,.52	.05,.46
	.10,.99	.10,.91	.10,.75	.10,.64	.10,.56	.10,.49	.10,.44
PO=.98	.01,.99	.01,.99	.01,.99	.01,.83	.01,.70	.01,.61	.01,.54
	.05,.99	.05,.99	.05,.96	.05,.79	.05,.67	.05,.58	.05,.51
	.10,.99	.10,.99	.10,.91	.10,.75	.10,.64	.10,.55	.10,.49
PO=.99	.01,.99	.01,.99	.01,.99	.01,.99	.01,.82	.01,.70	.01,.60
	.05,.99	.05,.99	.05,.99	.05,.96	.05,.79	.05,.67	.05,.58
	.10,.99	.10,.99	.10,.99	.10,.91	.10,.75	.10,.64	.10,.55

TEST EQUIPMENT CHARACTERISTICS
FOR
PRE-STORAGE TESTING

Values shown are ATE alpha and beta error probabilities

which will give an initial inventory reliability of .96

	D = .01	D = .02	D = .03	D = .04	D = .05	D = .06	D = .07
PO=.90	.01,.34	.01,.31	.01,.28	.01,.26	.01,.24	.01,.23	.01,.21
	.05,.32	.05,.30	.05,.27	.05,.25	.05,.23	.05,.22	.05,.20
	.10,.31	.10,.28	.10,.26	.10,.24	.10,.22	.10,.21	.10,.19
PO=.91	.01,.37	.01,.34	.01,.31	.01,.29	.01,.26	.01,.24	.01,.23
	.05,.36	.05,.33	.05,.30	.05,.27	.05,.25	.05,.23	.05,.22
	.10,.34	.10,.31	.10,.28	.10,.26	.10,.24	.10,.22	.10,.21
PO=.92	.01,.42	.01,.38	.01,.34	.01,.31	.01,.29	.01,.26	.01,.24
	.05,.40	.05,.36	.05,.33	.05,.30	.05,.27	.05,.25	.05,.23
	.10,.38	.10,.34	.10,.31	.10,.28	.10,.26	.10,.24	.10,.22
PO=.93	.01,.48	.01,.42	.01,.38	.01,.34	.01,.31	.01,.29	.01,.26
	.05,.46	.05,.41	.05,.36	.05,.33	.05,.30	.05,.28	.05,.25
	.10,.44	.10,.39	.10,.35	.10,.31	.10,.28	.10,.26	.10,.24
PO=.94	.01,.55	.01,.48	.01,.43	.01,.38	.01,.34	.01,.31	.01,.29
	.05,.53	.05,.46	.05,.41	.05,.37	.05,.33	.05,.30	.05,.28
	.10,.50	.10,.44	.10,.39	.10,.35	.10,.31	.10,.28	.10,.26
PO=.95	.01,.65	.01,.56	.01,.48	.01,.43	.01,.38	.01,.34	.01,.31
	.05,.63	.05,.53	.05,.46	.05,.41	.05,.37	.05,.33	.05,.30
	.10,.59	.10,.51	.10,.44	.10,.39	.10,.35	.10,.31	.10,.28
PO=.96	.01,.79	.01,.66	.01,.56	.01,.48	.01,.43	.01,.38	.01,.34
	.05,.76	.05,.63	.05,.54	.05,.47	.05,.41	.05,.37	.05,.33
	.10,.72	.10,.60	.10,.51	.10,.44	.10,.39	.10,.35	.10,.31
PO=.97	.01,.99	.01,.79	.01,.66	.01,.56	.01,.48	.01,.43	.01,.38
	.05,.96	.05,.76	.05,.63	.05,.54	.05,.46	.05,.41	.05,.36
	.10,.91	.10,.72	.10,.60	.10,.51	.10,.44	.10,.39	.10,.35
PO=.98	.01,.99	.01,.99	.01,.79	.01,.66	.01,.56	.01,.48	.01,.42
	.05,.99	.05,.96	.05,.76	.05,.63	.05,.53	.05,.46	.05,.41
	.10,.99	.10,.91	.10,.72	.10,.60	.10,.51	.10,.44	.10,.39
PO=.99	.01,.99	.01,.99	.01,.99	.01,.79	.01,.65	.01,.55	.01,.48
	.05,.99	.05,.99	.05,.96	.05,.76	.05,.63	.05,.53	.05,.46
	.10,.99	.10,.99	.10,.91	.10,.72	.10,.59	.10,.50	.10,.44

TEST EQUIPMENT CHARACTERISTICS

FOR

PRE-STORAGE TESTING

Values shown are ATE alpha and beta error probabilities

which will give an initial inventory reliability of .97

	D = .01	D = .02	D = .03	D = .04	D = .05	D = .06	D = .07
PO=.90	.01,.25	.01,.23	.01,.21	.01,.19	.01,.18	.01,.17	.01,.16
	.05,.24	.05,.22	.05,.20	.05,.19	.05,.17	.05,.16	.05,.15
	.10,.23	.10,.21	.10,.19	.10,.18	.10,.16	.10,.15	.10,.14
PO=.91	.01,.28	.01,.25	.01,.23	.01,.21	.01,.20	.01,.18	.01,.17
	.05,.27	.05,.24	.05,.22	.05,.20	.05,.19	.05,.17	.05,.16
	.10,.25	.10,.23	.10,.21	.10,.19	.10,.18	.10,.16	.10,.15
PO=.92	.01,.31	.01,.28	.01,.25	.01,.23	.01,.21	.01,.20	.01,.18
	.05,.30	.05,.27	.05,.24	.05,.22	.05,.20	.05,.19	.05,.17
	.10,.28	.10,.26	.10,.23	.10,.21	.10,.19	.10,.18	.10,.16
PO=.93	.01,.36	.01,.31	.01,.28	.01,.26	.01,.23	.01,.21	.01,.20
	.05,.34	.05,.30	.05,.27	.05,.24	.05,.22	.05,.20	.05,.19
	.10,.32	.10,.29	.10,.26	.10,.23	.10,.21	.10,.19	.10,.18
PO=.94	.01,.41	.01,.36	.01,.32	.01,.28	.01,.26	.01,.23	.01,.21
	.05,.39	.05,.34	.05,.30	.05,.27	.05,.25	.05,.22	.05,.20
	.10,.37	.10,.33	.10,.29	.10,.26	.10,.23	.10,.21	.10,.19
PO=.95	.01,.48	.01,.41	.01,.36	.01,.32	.01,.28	.01,.26	.01,.23
	.05,.46	.05,.40	.05,.34	.05,.30	.05,.27	.05,.25	.05,.22
	.10,.44	.10,.38	.10,.33	.10,.29	.10,.26	.10,.23	.10,.21
PO=.96	.01,.59	.01,.49	.01,.41	.01,.36	.01,.32	.01,.28	.01,.26
	.05,.56	.05,.47	.05,.40	.05,.35	.05,.30	.05,.27	.05,.24
	.10,.53	.10,.44	.10,.38	.10,.33	.10,.29	.10,.26	.10,.23
PO=.97	.01,.74	.01,.59	.01,.49	.01,.41	.01,.36	.01,.32	.01,.28
	.05,.71	.05,.57	.05,.47	.05,.40	.05,.34	.05,.30	.05,.27
	.10,.67	.10,.54	.10,.44	.10,.38	.10,.33	.10,.29	.10,.26
PO=.98	.01,.99	.01,.74	.01,.59	.01,.49	.01,.41	.01,.36	.01,.31
	.05,.96	.05,.71	.05,.57	.05,.47	.05,.40	.05,.34	.05,.30
	.10,.91	.10,.68	.10,.54	.10,.44	.10,.38	.10,.33	.10,.29
PO=.99	.01,.99	.01,.99	.01,.74	.01,.59	.01,.48	.01,.41	.01,.36
	.05,.99	.05,.96	.05,.71	.05,.56	.05,.46	.05,.39	.05,.34
	.10,.99	.10,.91	.10,.67	.10,.53	.10,.44	.10,.37	.10,.32

TEST EQUIPMENT CHARACTERISTICS

FOR

PRE-STORAGE TESTING

Values shown are ATE alpha and beta error probabilities

which will give an initial inventory reliability of .98

	D = .01	D = .02	D = .03	D = .04	D = .05	D = .06	D = .07
PO=.90	.01,.17	.01,.15	.01,.14	.01,.13	.01,.12	.01,.11	.01,.10
	.05,.16	.05,.14	.05,.13	.05,.12	.05,.11	.05,.11	.05,.10
	.10,.15	.10,.14	.10,.13	.10,.12	.10,.11	.10,.10	.10,.09
PO=.91	.01,.18	.01,.17	.01,.15	.01,.14	.01,.13	.01,.12	.01,.11
	.05,.18	.05,.16	.05,.15	.05,.13	.05,.12	.05,.11	.05,.11
	.10,.17	.10,.15	.10,.14	.10,.13	.10,.12	.10,.11	.10,.10
PO=.92	.01,.21	.01,.19	.01,.17	.01,.15	.01,.14	.01,.13	.01,.12
	.05,.20	.05,.18	.05,.16	.05,.15	.05,.13	.05,.12	.05,.11
	.10,.19	.10,.17	.10,.15	.10,.14	.10,.13	.10,.12	.10,.11
PO=.93	.01,.23	.01,.21	.01,.19	.01,.17	.01,.15	.01,.14	.01,.13
	.05,.23	.05,.20	.05,.18	.05,.16	.05,.15	.05,.13	.05,.12
	.10,.21	.10,.19	.10,.17	.10,.15	.10,.14	.10,.13	.10,.12
PO=.94	.01,.27	.01,.24	.01,.21	.01,.19	.01,.17	.01,.15	.01,.14
	.05,.26	.05,.23	.05,.20	.05,.18	.05,.16	.05,.15	.05,.13
	.10,.25	.10,.21	.10,.19	.10,.17	.10,.15	.10,.14	.10,.13
PO=.95	.01,.32	.01,.27	.01,.24	.01,.21	.01,.19	.01,.17	.01,.15
	.05,.31	.05,.26	.05,.23	.05,.20	.05,.18	.05,.16	.05,.15
	.10,.29	.10,.25	.10,.22	.10,.19	.10,.17	.10,.15	.10,.14
PO=.96	.01,.39	.01,.32	.01,.27	.01,.24	.01,.21	.01,.19	.01,.17
	.05,.37	.05,.31	.05,.26	.05,.23	.05,.20	.05,.18	.05,.16
	.10,.35	.10,.29	.10,.25	.10,.22	.10,.19	.10,.17	.10,.15
PO=.97	.01,.49	.01,.39	.01,.32	.01,.27	.01,.24	.01,.21	.01,.19
	.05,.47	.05,.37	.05,.31	.05,.26	.05,.23	.05,.20	.05,.18
	.10,.44	.10,.35	.10,.29	.10,.25	.10,.22	.10,.19	.10,.17
PO=.98	.01,.66	.01,.49	.01,.39	.01,.32	.01,.27	.01,.24	.01,.21
	.05,.63	.05,.47	.05,.37	.05,.31	.05,.26	.05,.23	.05,.20
	.10,.60	.10,.45	.10,.35	.10,.29	.10,.25	.10,.21	.10,.19
PO=.99	.01,.99	.01,.66	.01,.49	.01,.39	.01,.32	.01,.27	.01,.23
	.05,.95	.05,.63	.05,.47	.05,.37	.05,.31	.05,.26	.05,.23
	.10,.90	.10,.60	.10,.44	.10,.35	.10,.29	.10,.25	.10,.21

TEST EQUIPMENT CHARACTERISTICS

FOR

PRE-STORAGE TESTING

Values shown are ATE alpha and beta error probabilities

which will give an initial inventory reliability of .99

	D = .01	D = .02	D = .03	D = .04	D = .05	D = .06	D = .07
PO=.90	.01,.08	.01,.07	.01,.07	.01,.06	.01,.06	.01,.05	.01,.05
	.05,.08	.05,.07	.05,.07	.05,.06	.05,.06	.05,.05	.05,.05
	.10,.07	.10,.07	.10,.06	.10,.06	.10,.05	.10,.05	.10,.05
PO=.91	.01,.09	.01,.08	.01,.08	.01,.07	.01,.06	.01,.06	.01,.06
	.05,.09	.05,.08	.05,.07	.05,.07	.05,.06	.05,.06	.05,.05
	.10,.08	.10,.07	.10,.07	.10,.06	.10,.06	.10,.05	.10,.05
PO=.92	.01,.10	.01,.09	.01,.08	.01,.08	.01,.07	.01,.06	.01,.06
	.05,.10	.05,.09	.05,.08	.05,.07	.05,.07	.05,.06	.05,.06
	.10,.09	.10,.08	.10,.08	.10,.07	.10,.06	.10,.06	.10,.05
PO=.93	.01,.12	.01,.10	.01,.09	.01,.08	.01,.08	.01,.07	.01,.06
	.05,.11	.05,.10	.05,.09	.05,.08	.05,.07	.05,.07	.05,.06
	.10,.11	.10,.09	.10,.08	.10,.08	.10,.07	.10,.06	.10,.06
PO=.94	.01,.13	.01,.12	.01,.10	.01,.09	.01,.08	.01,.08	.01,.07
	.05,.13	.05,.11	.05,.10	.05,.09	.05,.08	.05,.07	.05,.07
	.10,.12	.10,.11	.10,.09	.10,.08	.10,.08	.10,.07	.10,.06
PO=.95	.01,.16	.01,.13	.01,.12	.01,.10	.01,.09	.01,.08	.01,.08
	.05,.15	.05,.13	.05,.11	.05,.10	.05,.09	.05,.08	.05,.07
	.10,.14	.10,.12	.10,.11	.10,.09	.10,.08	.10,.08	.10,.07
PO=.96	.01,.19	.01,.16	.01,.14	.01,.12	.01,.10	.01,.09	.01,.08
	.05,.18	.05,.15	.05,.13	.05,.11	.05,.10	.05,.09	.05,.08
	.10,.17	.10,.14	.10,.12	.10,.11	.10,.09	.10,.08	.10,.08
PO=.97	.01,.24	.01,.19	.01,.16	.01,.14	.01,.12	.01 .10	.01,.09
	.05,.23	.05,.18	.05,.15	.05,.13	.05,.11	.05,.10	.05,.09
	.10,.22	.10,.17	.10,.14	.10,.12	.10,.11	.10,.09	.10,.08
PO=.98	.01,.33	.01,.24	.01,.19	.01,.16	.01,.13	.01,.12	.01,.10
	.05,.31	.05,.23	.05,.18	.05,.15	.05,.13	.05,.11	.05,.10
	.10,.30	.10,.22	.10,.17	.10,.14	.10,.12	.10,.11	.10,.09
PO=.99	.01,.49	.01,.33	.01,.24	.01,.19	.01,.16	.01,.13	.01,.12
	.05,.47	.05,.31	.05,.23	.05,.18	.05,.15	.05,.13	.05,.11
	.10,.45	.10,.30	.10,.22	.10,.17	.10,.14	.10,.12	.10,.11

APPENDIX

APPENDIX C

SURVEILLANCE COMPUTER PROGRAM

```
100 REM                  Executive Routine
110 GOSUB 1000           'Initialize
120 FOR B=.05 TO .51 STEP .05
130 FOR D=0 TO .101 STEP .05
140 FOR K=1 TO 8
160 RM=R1(K)
170 REM                  Check for No Sampling Required
180 S=.0001:GOSUB 2000
190 IF R(10)>RM THEN S=0:GOTO 350
200 REM                  Check For More Than 100% Sampling Req'd
210 SL=0:RL=R(10)
220 S=1:GOSUB 2000
230 IF R(10)<RM THEN S=1:GOTO 350
240 SH=1:RH=R(10)
250 REM                  Begin Bisection Algorithm
260 S=(SH+SL)/2
270 GOSUB 2000
280 IF R(10)<RM THEN SL=S:RL=R(10):GOTO 300
290 SH=S:RH=R(10)
300 REM                  Check To See if Through
310 IF SH-SL<.0005 THEN GOTO 340
320 REM                  Not Through
330 GOTO 260
340 REM                  Through. Answer is sh to give r min
350 GOSUB 3000           'Screen Print
360 GOSUB 4000           'Disk Print
370 NEXT K
380 NEXT D
390 NEXT B
400 CLOSE
410 POKE 16916,,0
420 END
1000 REM                  Initialization
1010 REM
1020 FOR L=1 TO 8:READ R1(L):NEXT L:RESTORE
1030 DATA .70,.75,.80,.85,.90,.95,.97,.99
1040 CLS
1050 PRINT:INPUT"Input the production reliability Po ";PO
1060 PRINT:INPUT"Input the test set alpha ";A
1070 PRINT:INPUT"Input the missile average life m ";M
1080  PRINT:INPUT"Input data file  name  (/dat will  be  added)
";S$
1090 S$=S$+"/dat"
1100 T=8760
1110  REM                  t is  the  number of  hours  per  test
period
1120 RETURN
2000 REM                  Calculate R(10)
2010 REM
2020 R(0)=1/(1+(B*(1-PO*(1-D)))/(PO*(1-D)*(1-A)))
2030 REM                  R(0) is initial storage reliability
2040 FOR I=1 TO 10
2050 REM             Failure in Storage
2060 R(I)=R(I-1)*EXP(-T/M)
2070 Q(I)=1-R(I)
2080 REM             Sample Yes
```

```
2090 G2=S*R(I)
2100 B2=S*Q(I)
2110 REM          Insert Test Damage
2120 G3=G2*(1-D)
2130 B3=B2+D*G2
2140 REM         Conduct Test: Test Bad
2150 G4=G3*A
2160 B4=B3*(1-B)
2170 REM         Ship, Repair & Ship
2180 G5=PO*(G4+B4)
2190 B5=(1-PO)*(G4+B4)
2200 REM         Receiving Inspection
2210 G6=(G5+B5)*(1/(1+(B*(B5+G5*D))/(G5*(1-D)*(1-A))))
2220 B6=G5+B5-G6
2230 REM         Sample No
2240 G7=R(I)*(1-S)
2250 B7=Q(I)*(1-S)
2260 REM         Conduct Test: Test Good
2270 G8=G3*(1-A)
2280 B8=B3*B
2290 REM         Collect Good and Bad Missiles
2300 R(I)=G6+G7+G8
2310 Q(I)=B6+B7+B8
2320 NEXT I
2330 RETURN
3000 REM               Screen Print
3010 REM
3020 IF PF=0 THEN CLS:POKE 16916,4
3030 IF PF=1 THEN GOTO 3090
3040 PRINT"Values shown for M = ";M;" Po = ";PO;" a = ";A
3050 PRINT
3060 PRINT"  Beta     d       R min     s"
3070 PRINT" =====    ====      =====    ====="
3080   B$="  .##     .##       .##      .###"
3090 PRINT USING B$;B,D,RM,S
3100 PF=1
3110 RETURN
4000 REM                Disk Print
4010 REM
4020 IF DPF=1 THEN GOTO 4050
4030 OPEN "O",1,S$
4040 PRINT#1,PO;A;M;T
4050 PRINT#1,B;D;RM;S
4060 DPF=1
4070 RETURN
```

APPENDIX

APPENDIX D

TABLES FOR SURVEILLANCE TESTING

STATISTICAL SURVEILLANCE PLANS
FOR
SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 50000 , T = 8760 , Po = .95 , Alpha = .01)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.286	.342	.413	.503	.625	.795	.885	.993
	.05 :	.288	.345	.417	.508	.631	.807	.899	----
	.10 :	.291	.348	.420	.514	.640	.820	.916	----
.10	.00 :	.302	.362	.437	.533	.661	.841	.937	----
	.05 :	.307	.369	.445	.543	.677	.868	.968	----
	.10 :	.312	.375	.455	.557	.697	.898	----	----
.15	.00 :	.321	.384	.463	.565	.702	.894	.995	----
	.05 :	.329	.395	.477	.584	.729	.938	----	----
	.10 :	.337	.406	.493	.607	.763	.991	----	----
.20	.00 :	.342	.410	.494	.602	.748	.952	----	----
	.05 :	.353	.424	.514	.631	.790	----	----	----
	.10 :	.366	.442	.539	.666	.841	----	----	----
.25	.00 :	.366	.438	.529	.644	.799	----	----	----
	.05 :	.381	.459	.557	.685	.860	----	----	----
	.10 :	.400	.484	.591	.735	.936	----	----	----
.30	.00 :	.393	.471	.568	.692	.859	----	----	----
	.05 :	.415	.500	.607	.749	.943	----	----	----
	.10 :	.440	.534	.656	.820	----	----	----	----
.35	.00 :	.424	.508	.613	.748	.927	----	----	----
	.05 :	.453	.547	.667	.824	----	----	----	----
	.10 :	.488	.594	.734	.924	----	----	----	----
.40	.00 :	.461	.552	.666	.812	----	----	----	----
	.05 :	.499	.604	.737	.915	----	----	----	----
	.10 :	.545	.668	.832	----	----	----	----	----
.45	.00 :	.504	.604	.729	.888	----	----	----	----
	.05 :	.554	.672	.824	----	----	----	----	----
	.10 :	.619	.762	.956	----	----	----	----	----
.50	.00 :	.556	.667	.803	.980	----	----	----	----
	.05 :	.624	.758	.933	----	----	----	----	----
	.10 :	.711	.884	----	----	----	----	----	----

STATISTICAL SURVEILLANCE PLANS

FOR

SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 100000 , T = 8760 , Po = .95 , Alpha = .01)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.155	.201	.259	.337	.454	.649	.771	.942
	.05 :	.157	.203	.262	.342	.461	.664	.792	.973
	.10 :	.159	.206	.266	.347	.470	.681	.816	----
.10	.00 :	.165	.212	.274	.358	.480	.687	.817	.998
	.05 :	.167	.217	.281	.368	.498	.720	.864	----
	.10 :	.172	.223	.290	.380	.518	.762	.922	----
.15	.00 :	.174	.226	.292	.379	.510	.729	.867	----
	.05 :	.180	.234	.303	.397	.540	.788	.949	----
	.10 :	.188	.244	.317	.418	.576	.863	----	----
.20	.00 :	.186	.241	.310	.405	.543	.777	.924	----
	.05 :	.195	.253	.328	.431	.588	.867	----	----
	.10 :	.206	.267	.349	.463	.646	.992	----	----
.25	.00 :	.200	.257	.333	.433	.582	.832	.989	----
	.05 :	.212	.275	.357	.471	.646	.963	----	----
	.10 :	.227	.295	.387	.519	.735	----	----	----
.30	.00 :	.214	.277	.357	.465	.625	.893	----	----
	.05 :	.232	.300	.391	.518	.716	----	----	----
	.10 :	.252	.330	.434	.588	.849	----	----	----
.35	.00 :	.232	.299	.385	.502	.674	.964	----	----
	.05 :	.255	.332	.432	.575	.801	----	----	----
	.10 :	.284	.372	.494	.677	----	----	----	----
.40	.00 :	.252	.326	.419	.545	.733	----	----	----
	.05 :	.283	.369	.482	.645	.909	----	----	----
	.10 :	.322	.424	.569	.794	----	----	----	----
.45	00 :	.276	.356	.458	.597	.802	----	----	----
	.05 :	.317	.414	.543	.733	----	----	----	----
	.10 :	.371	.493	.668	.958	----	----	----	----
.50	.00 :	.305	.393	.506	.659	.885	----	----	----
	.05 :	.360	.471	.622	.847	----	----	----	----
	.10 :	.434	.583	.807	----	----	----	----	----

STATISTICAL SURVEILLANCE PLANS

FOR

SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 200000 , T = 8760 , Po = .95 , Alpha = .01)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.036	.074	.123	.189	.288	.473	.613	.855
	.05 :	.037	.076	.125	.193	.294	.490	.639	.905
	.10 :	.039	.078	.128	.197	.302	.508	.671	.968
.10	.00 :	.039	.080	.130	.200	.304	.501	.649	.905
	.05 :	.042	.083	.136	.208	.320	.538	.710	----
	.10 :	.044	.087	.143	.219	.338	.584	.792	----
.15	.00 :	.042	.084	.139	.212	.324	.533	.690	.961
	.05 :	.046	.091	.149	.227	.350	.596	.797	----
	.10 :	.052	.099	.160	.245	.382	.685	.962	----
.20	.00 :	.045	.091	.149	.227	.345	.567	.735	----
	.05 :	.052	.101	.164	.250	.385	.667	.909	----
	.10 :	.061	.113	.180	.277	.439	.826	----	----
.25	.00 :	.049	.098	.160	.244	.370	.607	.787	----
	.05 :	.059	.112	.180	.275	.427	.757	----	----
	.10 :	.071	.128	.206	.316	.511	----	----	----
.30	.00 :	.054	.107	.172	.262	.397	.653	.845	----
	.05 :	.068	.125	.201	.306	.480	.875	----	----
	.10 :	.083	.149	.236	.367	.611	----	----	----
.35	.00 :	.060	.117	.187	.284	.429	.705	.914	----
	.05 :	.077	.141	.224	.344	.545	----	----	----
	.10 :	.099	.173	.275	.433	.752	----	----	----
.40	.00 :	.067	.127	.205	.309	.467	.766	.994	----
	.05 :	.088	.160	.254	.391	.630	----	----	----
	.10 :	.118	.205	.327	.525	.975	----	----	----
.45	.00 :	.074	.140	.224	.338	.511	.838	----	----
	.05 :	.103	.184	.292	.453	.744	----	----	----
	.10 :	.143	.248	.398	.661	----	----	----	----
.50	.00 :	.083	.156	.249	.374	.564	.926	----	----
	.05 :	.122	.214	.341	.534	.904	----	----	----
	.10 :	.178	.306	.501	.878	----	----	----	----

STATISTICAL SURVEILLANCE PLANS
FOR
SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 300000 , T = 8760 , Po = .95 , Alpha = .01)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.000	.004	.049	.110	.200	.371	.508	.782
	.05 :	.000	.005	.051	.113	.206	.386	.536	.846
	.10 :	.000	.007	.054	.117	.212	.404	.570	.931
.10	.00 :	.000	.006	.053	.117	.212	.393	.539	.828
	.05 :	.000	.009	.058	.125	.226	.427	.603	.986
	.10 :	.000	.013	.065	.134	.243	.473	.694	----
.15	.00 :	.000	.008	.058	.125	.226	.417	.572	.879
	.05 :	.000	.014	.067	.138	.250	.479	.688	----
	.10 :	.000	.020	.077	.154	.279	.568	.882	----
.20	.00 :	.000	.010	.063	.134	.241	.445	.610	.938
	.05 :	.000	.018	.076	.154	.277	.542	.799	----
	.10 :	.000	.028	.090	.178	.326	.708	----	----
.25	.00 :	.000	.012	.069	.145	.258	.476	.653	----
	.05 :	.000	.024	.086	.172	.311	.625	.952	----
	.10 :	.000	.038	.108	.209	.387	.931	----	----
.30	.00 :	.000	.015	.076	.157	.279	.512	.702	----
	.05 :	.000	.031	.099	.196	.353	.733	----	----
	.10 :	.000	.049	.129	.250	.473	----	----	----
.35	.00 :	.000	.019	.083	.171	.302	.553	.758	----
	.05 :	.000	.038	.115	.223	.406	.886	----	----
	.10 :	.000	.064	.158	.303	.601	----	----	----
.40	.00 :	.000	.022	.093	.187	.329	.602	.825	----
	.05 :	.000	.047	.134	.258	.475	----	----	----
	.10 :	.001	.083	.196	.378	.812	----	----	----
.45	00 :	.000	.027	.103	.207	.361	.660	.904	----
	.05 :	.000	.059	.159	.305	.571	----	----	----
	.10 :	.011	.110	.250	.494	----	----	----	----
.50	.00 :	.000	.032	.116	.229	.399	.728	.999	----
	.05 :	.000	.075	.191	.367	.709	----	----	----
	.10 :	.025	.148	.332	.637	----	----	----	----

STATISTICAL SURVEILLANCE PLANS
FOR
SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 400000 , T = 8760 , Po = .95 , Alpha = .01)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.000	.000	.000	.056	.141	.302	.434	.720
	.05 :	.000	.000	.001	.060	.147	.316	.460	.794
	.10 :	.000	.000	.003	.063	.154	.333	.495	.897
.10	.00 :	.000	.000	.000	.061	.151	.320	.459	.763
	.05 :	.000	.000	.005	.069	.164	.353	.524	.950
	.10 :	.000	.000	.011	.077	.179	.396	.617	----
.15	.00 :	.000	.000	.003	.067	.162	.340	.489	.811
	.05 :	.000	.000	.011	.079	.183	.398	.605	----
	.10 :	.000	.000	.020	.093	.210	.485	.814	----
.20	.00 :	.000	.000	.005	.073	.173	.363	.521	.865
	.05 :	.000	.000	.017	.091	.207	.456	.713	----
	.10 :	.000	.000	.030	.113	.250	.619	----	----
.25	.00 :	.000	.000	.008	.081	.186	.389	.557	.926
	.05 :	.000	.000	.023	.105	.234	.530	.869	----
	.10 :	.000	.000	.042	.138	.305	.846	----	----
.30	.00 :	.000	.000	.012	.088	.202	.418	.600	.997
	.05 :	.000	.000	.032	.123	.269	.631	----	----
	.10 :	.000	.000	.058	.170	.381	----	----	----
.35	.00 :	.000	.000	.015	.097	.219	.453	.648	----
	.05 :	.000	.000	.041	.143	.314	.777	----	----
	.10 :	.000	.000	.078	.215	.497	----	----	----
.40	.00 :	.000	.000	.020	.108	.240	.493	.706	----
	.05 :	.000	.000	.053	.170	.374	----	----	----
	.10 :	.000	.000	.106	.280	.695	----	----	----
.45	.00 :	.000	.000	.024	.121	.264	.541	.773	----
	.05 :	.000	.000	.068	.207	.456	----	----	----
	.10 :	.000	.009	.146	.379	----	----	----	----
.50	.00 :	.000	.000	.030	.136	.293	.597	.854	----
	.05 :	.000	.000	.088	.255	.578	----	----	----
	.10 :	.000	.028	.209	.554	----	----	----	----

STATISTICAL SURVEILLANCE PLANS

FOR

SAMPLING FROM STORAGE

Values shown are population proportions required to yield a minimum inventory reliability of RM where

(M = 50000 , T = 8760 , Po = .95 , Alpha = .05)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.286	.342	.413	.503	.625	.795	.886	.994
	.05 :	.288	.345	.417	.508	.632	.808	.901	----
	.10 :	.291	.348	.421	.514	.641	.822	.917	----
.10	.00 :	.302	.363	.437	.533	.662	.842	.938	----
	.05 :	.307	.369	.446	.544	.678	.870	.971	----
	.10 :	.313	.375	.456	.558	.699	.902	----	----
.15	.00 :	.322	.385	.464	.566	.703	.895	.997	----
	.05 :	.330	.395	.478	.586	.732	.941	----	----
	.10 :	.338	.408	.495	.610	.767	.998	----	----
.20	.00 :	.342	.411	.495	.603	.749	.955	----	----
	.05 :	.354	.426	.516	.633	.793	----	----	----
	.10 :	.368	.444	.542	.669	.848	----	----	----
.25	.00 :	.367	.439	.530	.646	.801	----	----	----
	.05 :	.383	.461	.559	.688	.865	----	----	----
	.10 :	.402	.487	.596	.742	.946	----	----	----
.30	.00 :	.394	.472	.569	.694	.862	----	----	----
	.05 :	.417	.501	.611	.753	.951	----	----	----
	.10 :	.443	.539	.662	.827	----	----	----	----
.35	.00 :	.425	.510	.615	.750	.931	----	----	----
	.05 :	.456	.550	.670	.831	----	----	----	----
	.10 :	.492	.600	.743	.937	----	----	----	----
.40	.00 :	.462	.554	.668	.816	----	----	----	----
	.05 :	.502	.608	.744	.924	----	----	----	----
	.10 :	.551	.677	.843	----	----	----	----	----
.45	00 :	.506	.607	.732	.893	----	----	----	----
	.05 :	.559	.678	.833	----	----	----	----	----
	.10 :	.626	.774	.973	----	----	----	----	----
.50	.00 :	.559	.670	.808	.987	----	----	----	----
	.05 :	.629	.766	.945	----	----	----	----	----
	.10 :	.723	.901	----	----	----	----	----	----

STATISTICAL SURVEILLANCE PLANS
FOR
SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 100000 , T = 8760 , Po = .95 , Alpha = .05)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.155	.201	.259	.337	.454	.649	.772	.944
	.05 :	.157	.204	.262	.342	.462	.665	.793	.975
	.10 :	.159	.206	.266	.348	.471	.683	.819	----
.10	.00 :	.165	.212	.275	.358	.481	.688	.818	----
	.05 :	.168	.218	.282	.369	.499	.723	.868	----
	.10 :	.172	.224	.290	.381	.520	.767	.930	----
.15	.00 :	.175	.226	.292	.380	.511	.731	.870	----
	.05 :	.181	.235	.304	.399	.542	.792	.957	----
	.10 :	.188	.245	.318	.420	.580	.873	----	----
.20	.00 :	.187	.242	.311	.406	.545	.780	.928	----
	.05 :	.196	.254	.330	.433	.592	.875	----	----
	.10 :	.207	.269	.351	.467	.654	----	----	----
.25	.00 :	.200	.258	.333	.434	.583	.835	.995	----
	.05 :	.213	.277	.359	.474	.652	.976	----	----
	.10 :	.229	.298	.391	.526	.747	----	----	----
.30	.00 :	.215	.278	.358	.467	.627	.900	----	----
	.05 :	.233	.303	.394	.523	.724	----	----	----
	.10 :	.255	.333	.440	.598	.868	----	----	----
.35	.00 :	.233	.300	.387	.504	.679	.973	----	----
	.05 :	.257	.334	.436	.582	.814	----	----	----
	.10 :	.287	.376	.501	.691	----	----	----	----
.40	.00 :	.253	.327	.421	.549	.739	----	----	----
	.05 :	.286	.372	.488	.654	.927	----	----	----
	.10 :	.327	.431	.581	.816	----	----	----	----
.45	.00 :	.278	.359	.461	.602	.810	----	----	----
	.05 :	.321	.418	.551	.746	----	----	----	----
	.10 :	.377	.502	.686	.993	----	----	----	----
.50	.00 :	.307	.396	.510	.665	.895	----	----	----
	.05 :	.365	.478	.633	.867	----	----	----	----
	.10 :	.444	.599	.835	----	----	----	----	----

STATISTICAL SURVEILLANCE PLANS

FOR

SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 200000 , T = 8760 , Po = .95 , Alpha = .05)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.036	.075	.123	.189	.288	.474	.614	.857
	.05 :	.037	.076	.125	.193	.295	.491	.642	.910
	.10 :	.039	.079	.128	.198	.303	.510	.675	.976
.10	.00 :	.039	.080	.131	.201	.305	.502	.652	.910
	.05 :	.042	.083	.137	.209	.321	.541	.715	----
	.10 :	.045	.088	.144	.220	.340	.590	.802	----
.15	.00 :	.042	.085	.140	.213	.325	.535	.694	.968
	.05 :	.047	.092	.150	.229	.352	.602	.808	----
	.10 :	.053	.100	.162	.248	.387	.698	.986	----
.20	.00 :	.045	.091	.150	.228	.346	.571	.741	----
	.05 :	.053	.102	.165	.251	.389	.677	.926	----
	.10 :	.062	.114	.182	.280	.446	.849	----	----
.25	.00 :	.050	.099	.161	.245	.372	.612	.794	----
	.05 :	.060	.114	.182	.278	.433	.773	----	----
	.10 :	.073	.130	.208	.322	.523	----	----	----
.30	.00 :	.055	.108	.173	.264	.400	.660	.857	----
	.05 :	.069	.126	.203	.310	.488	.899	----	----
	.10 :	.085	.151	.241	.375	.629	----	----	----
.35	.00 :	.061	.117	.189	.286	.433	.714	.929	----
	.05 :	.079	.143	.228	.350	.557	----	----	----
	.10 :	.101	.177	.282	.446	.786	----	----	----
.40	.00 :	.067	.128	.207	.311	.472	.779	----	----
	.05 :	.090	.164	.259	.400	.648	----	----	----
	.10 :	.122	.210	.336	.545	----	----	----	----
.45	00 :	.075	.142	.227	.342	.518	.855	----	----
	.05 :	.106	.188	.298	.464	.771	----	----	----
	.10 :	.149	.255	.413	.695	----	----	----	----
.50	.00 :	.084	.158	.251	.379	.574	.949	----	----
	.05 :	.125	.220	.351	.551	.948	----	----	----
	.10 :	.186	.320	.526	.944	----	----	----	----

STATISTICAL SURVEILLANCE PLANS

FOR

SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 300000 , T = 8760 , Po = .95 , Alpha = .05)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.000	.004	.049	.110	.200	.372	.509	.784
	.05 :	.000	.006	.052	.114	.207	.387	.539	.852
	.10 :	.000	.008	.054	.118	.213	.406	.574	.942
.10	.00 :	.000	.006	.053	.118	.212	.394	.541	.833
	.05 :	.000	.010	.059	.125	.227	.431	.609	----
	.10 :	.000	.014	.065	.135	.245	.479	.706	----
.15	.00 :	.000	.008	.058	.125	.227	.419	.576	.889
	.05 :	.000	.014	.067	.139	.251	.485	.700	----
	.10 :	.000	.021	.078	.156	.283	.581	.912	----
.20	.00 :	.000	.010	.064	.135	.243	.448	.616	.952
	.05 :	.000	.019	.077	.156	.281	.552	.820	----
	.10 :	.000	.030	.092	.182	.332	.733	----	----
.25	.00 :	.000	.013	.070	.146	.260	.481	.662	----
	.05 :	.000	.025	.088	.175	.316	.640	.989	----
	.10 :	.000	.040	.111	.214	.398	.986	----	----
.30	.00 :	.000	.016	.077	.159	.281	.519	.713	----
	.05 :	.000	.032	.101	.199	.360	.759	----	----
	.10 :	.000	.051	.134	.256	.492	----	----	----
.35	.00 :	.000	.019	.084	.172	.305	.562	.775	----
	.05 :	.000	.040	.118	.228	.417	.931	----	----
	.10 :	.000	.067	.164	.314	.633	----	----	----
.40	.00 :	.000	.023	.094	.190	.333	.614	.846	----
	.05 :	.000	.049	.138	.266	.492	----	----	----
	.10 :	.004	.088	.205	.397	.880	----	----	----
.45	.00 :	.000	.028	.105	.209	.367	.675	.932	----
	.05 :	.000	.062	.165	.315	.596	----	----	----
	.10 :	.015	.117	.263	.525	----	----	----	----
.50	.00 :	.000	.034	.119	.233	.407	.750	----	----
	.05 :	.000	.079	.199	.382	.751	----	----	----
	.10 :	.030	.159	.354	.750	----	----	----	----

STATISTICAL SURVEILLANCE PLANS

FOR

SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 400000 , T = 8760 , Po = .95 , Alpha = .05)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.000	.000	.000	.056	.141	.302	.435	.723
	.05 :	.000	.000	.001	.060	.148	.317	.463	.801
	.10 :	.000	.000	.003	.064	.155	.335	.499	.910
.10	.00 :	.000	.000	.001	.062	.151	.321	.462	.769
	.05 :	.000	.000	.006	.069	.165	.356	.530	.969
	.10 :	.000	.000	.011	.078	.181	.402	.629	----
.15	.00 :	.000	.000	.003	.067	.162	.342	.493	.822
	.05 :	.000	.000	.011	.080	.185	.404	.617	----
	.10 :	.000	.000	.021	.095	.214	.497	.848	----
.20	.00 :	.000	.000	.006	.074	.174	.366	.527	.880
	.05 :	.000	.000	.017	.092	.209	.464	.736	----
	.10 :	.000	.000	.032	.116	.256	.644	----	----
.25	.00 :	.000	.000	.009	.082	.188	.393	.566	.949
	.05 :	.000	.000	.025	.107	.239	.545	.910	----
	.10 :	.000	.000	.044	.142	.315	.908	----	----
.30	.00 :	.000	.000	.012	.089	.204	.424	.611	----
	.05 :	.000	.000	.033	.125	.276	.657	----	----
	.10 :	.000	.000	.061	.177	.398	----	----	----
.35	.00 :	.000	.000	.016	.099	.222	.461	.664	----
	.05 :	.000	.000	.043	.148	.324	.823	----	----
	.10 :	.000	.000	.083	.226	.528	----	----	----
.40	.00 :	.000	.000	.021	.110	.244	.503	.726	----
	.05 :	.000	.000	.056	.177	.388	----	----	----
	.10 :	.000	.000	.113	.296	.762	----	----	----
.45	00 :	.000	.000	.026	.124	.270	.555	.801	----
	.05 :	.000	.000	.073	.215	.479	----	----	----
	.10 :	.000	.015	.158	.410	----	----	----	----
.50	.00 :	.000	.000	.032	.139	.300	.617	.892	----
	.05 :	.000	.000	.095	.269	.618	----	----	----
	.10 :	.000	.037	.230	.616	----	----	----	----

STATISTICAL SURVEILLANCE PLANS
FOR
SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 50000 , T = 8760 , Po = .98 , Alpha = .01)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.286	.341	.412	.502	.623	.793	.883	.992
	.05 :	.288	.344	.416	.507	.630	.805	.897	----
	.10 :	.290	.347	.419	.513	.638	.818	.913	----
.10	.00 :	.301	.361	.435	.531	.659	.838	.934	----
	.05 :	.306	.367	.443	.542	.674	.864	.964	----
	.10 :	.311	.374	.452	.554	.693	.893	----	----
.15	.00 :	.320	.382	.461	.562	.698	.889	.990	----
	.05 :	.327	.392	.474	.581	.725	.931	----	----
	.10 :	.335	.404	.490	.602	.757	.983	----	----
.20	.00 :	.339	.407	.491	.598	.743	.946	----	----
	.05 :	.350	.421	.510	.625	.783	----	----	----
	.10 :	.363	.438	.534	.659	.833	----	----	----
.25	.00 :	.363	.435	.524	.639	.792	----	----	----
	.05 :	.377	.455	.551	.678	.851	----	----	----
	.10 :	.396	.479	.584	.726	.924	----	----	----
.30	.00 :	.389	.466	.562	.685	.850	----	----	----
	.05 :	.410	.494	.600	.739	.930	----	----	----
	.10 :	.434	.527	.646	.807	----	----	----	----
.35	.00 :	.419	.502	.606	.739	.917	----	----	----
	.05 :	.447	.540	.657	.812	----	----	----	----
	.10 :	.480	.584	.721	.908	----	----	----	----
.40	.00 :	.455	.545	.657	.801	.994	----	----	----
	.05 :	.491	.594	.725	.899	----	----	----	----
	.10 :	.536	.657	.815	----	----	----	----	----
.45	.00 :	.497	.595	.717	.875	----	----	----	----
	.05 :	.544	.661	.809	----	----	----	----	----
	.10 :	.606	.746	.934	----	----	----	----	----
.50	.00 :	.547	.656	.791	.963	----	----	----	----
	.05 :	.611	.743	.914	----	----	----	----	----
	.10 :	.695	.863	----	----	----	----	----	----

STATISTICAL SURVEILLANCE PLANS

FOR

SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 100000 , T = 8760 , Po = .98 , Alpha = .01)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.155	.201	.258	.337	.453	.648	.770	.941
	.05 :	.156	.203	.261	.341	.460	.662	.790	.970
	.10 :	.158	.205	.265	.347	.469	.678	.813	----
.10	.00 :	.164	.211	.273	.356	.479	.684	.814	.994
	.05 :	.167	.216	.280	.367	.496	.717	.859	----
	.10 :	.171	.222	.288	.378	.515	.756	.916	----
.15	.00 :	.173	.224	.290	.377	.507	.725	.863	----
	.05 :	.179	.232	.301	.395	.536	.782	.941	----
	.10 :	.186	.242	.314	.415	.571	.853	----	----
.20	.00 :	.184	.239	.308	.402	.540	.771	.917	----
	.05 :	.193	.250	.325	.427	.583	.858	----	----
	.10 :	.204	.264	.345	.458	.638	.977	----	----
.25	.00 :	.197	.255	.329	.429	.576	.824	.980	----
	.05 :	.209	.272	.353	.465	.638	.951	----	----
	.10 :	.224	.292	.382	.512	.723	----	----	----
.30	.00 :	.211	.274	.353	.460	.618	.883	----	----
	.05 :	.228	.296	.386	.511	.706	----	----	----
	.10 :	.248	.325	.427	.579	.832	----	----	----
.35	.00 :	.228	.295	.380	.496	.667	.953	----	----
	.05 :	.250	.326	.425	.565	.788	----	----	----
	.10 :	.278	.365	.484	.663	.976	----	----	----
.40	.00 :	.248	.320	.413	.538	.723	----	----	----
	.05 :	.277	.361	.473	.632	.890	----	----	----
	.10 :	.314	.415	.555	.774	----	----	----	----
.45	.00 :	.270	.350	.451	.587	.790	----	----	----
	.05 :	.309	.405	.532	.716	----	----	----	----
	.10 :	.361	.480	.650	.927	----	----	----	----
.50	.00 :	.297	.385	.497	.647	.870	----	----	----
	.05 :	.350	.459	.607	.826	----	----	----	----
	.10 :	.421	.566	.781	----	----	----	----	----

STATISTICAL SURVEILLANCE PLANS

FOR

SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 200000 , T = 8760 , Po = .98 , Alpha = .01)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.035	.074	.123	.188	.287	.472	.612	.853
	.05 :	.037	.076	.125	.192	.293	.488	.637	.902
	.10 :	.038	.078	.127	.196	.301	.506	.667	.962
.10	.00 :	.038	.078	.129	.199	.303	.500	.647	.902
	.05 :	.041	.082	.135	.208	.318	.535	.706	----
	.10 :	.043	.086	.141	.217	.335	.580	.784	----
.15	.00 :	.040	.083	.137	.210	.322	.530	.686	.956
	.05 :	.044	.089	.147	.225	.347	.590	.790	----
	.10 :	.050	.097	.158	.242	.378	.676	.946	----
.20	.00 :	.042	.088	.147	.224	.342	.563	.729	----
	.05 :	.049	.098	.161	.246	.380	.660	.895	----
	.10 :	.058	.110	.177	.273	.432	.809	----	----
.25	.00 :	.046	.095	.157	.240	.366	.601	.779	----
	.05 :	.055	.108	.176	.271	.421	.746	----	----
	.10 :	.067	.125	.200	.310	.501	----	----	----
.30	.00 :	.050	.102	.168	.257	.392	.645	.835	----
	.05 :	.063	.121	.195	.300	.471	.856	----	----
	.10 :	.078	.143	.229	.358	.594	----	----	----
.35	.00 :	.054	.111	.182	.278	.423	.696	.901	----
	.05 :	.071	.134	.218	.336	.534	----	----	----
	.10 :	.091	.166	.266	.421	.728	----	----	----
.40	.00 :	.059	.121	.198	.301	.458	.754	.978	----
	.05 :	.081	.152	.246	.381	.614	----	----	----
	.10 :	.109	.195	.315	.507	.932	----	----	----
.45	.00 :	.066	.132	.216	.330	.501	.825	----	----
	.05 :	.093	.174	.282	.439	.721	----	----	----
	.10 :	.132	.235	.382	.633	----	----	----	----
.50	.00 :	.073	.146	.239	.364	.552	.908	----	----
	.05 :	.110	.203	.328	.516	.872	----	----	----
	.10 :	.164	.290	.479	.833	----	----	----	----

STATISTICAL SURVEILLANCE PLANS FOR SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 300000 , T = 8760 , Po = .98 , Alpha = .01)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.000	.003	.048	.109	.199	.370	.507	.780
	.05 :	.000	.004	.050	.112	.205	.384	.534	.842
	.10 :	.000	.006	.053	.116	.211	.402	.566	.923
.10	.00 :	.000	.004	.051	.116	.210	.391	.537	.825
	.05 :	.000	.007	.057	.123	.224	.425	.598	.976
	.10 :	.000	.011	.062	.131	.240	.468	.685	----
.15	.00 :	.000	.004	.055	.123	.223	.415	.569	.875
	.05 :	.000	.010	.064	.135	.247	.474	.679	----
	.10 :	.000	.017	.073	.151	.275	.559	.863	----
.20	.00 :	.000	.006	.059	.131	.238	.441	.605	.930
	.05 :	.000	.014	.072	.150	.273	.535	.786	----
	.10 :	.000	.024	.085	.173	.319	.690	----	----
.25	.00 :	.000	.007	.064	.140	.254	.471	.646	.994
	.05 :	.000	.018	.081	.167	.305	.613	.929	----
	.10 :	.000	.032	.102	.203	.377	.896	----	----
.30	.00 :	.000	.008	.070	.151	.273	.505	.694	----
	.05 :	.000	.023	.092	.188	.344	.715	----	----
	.10 :	.000	.042	.122	.240	.458	----	----	----
.35	.00 :	.000	.010	.076	.164	.294	.545	.748	----
	.05 :	.000	.029	.106	.214	.395	.858	----	----
	.10 :	.000	.053	.147	.291	.578	----	----	----
.40	.00 :	.000	.011	.083	.177	.320	.591	.811	----
	.05 :	.000	.036	.123	.248	.460	----	----	----
	.10 :	.000	.070	.182	.361	.770	----	----	----
.45	.00 :	.000	.013	.091	.195	.350	.646	.886	----
	.05 :	.000	.044	.144	.290	.550	----	----	----
	.10 :	.000	.092	.232	.468	----	----	----	----
.50	.00 :	.000	.016	.101	.215	.386	.712	.977	----
	.05 :	.000	.056	.173	.348	.679	----	----	----
	.10 :	.001	.125	.307	.645	----	----	----	----

STATISTICAL SURVEILLANCE PLANS
FOR
SAMPLING FROM STORAGE

Values shown are population proportions required to yield a minimum inventory reliability of RM where

(M = 400000 , T = 8760 , Po = .98 , Alpha = .01)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.000	.000	.000	.055	.140	.301	.433	.719
	.05 :	.000	.000	.000	.058	.146	.315	.459	.791
	.10 :	.000	.000	.002	.062	.152	.332	.492	.888
.10	.00 :	.000	.000	.000	.059	.149	.318	.458	.760
	.05 :	.000	.000	.002	.066	.162	.350	.519	.938
	.10 :	.000	.000	.008	.075	.176	.392	.608	----
.15	.00 :	.000	.000	.000	.063	.158	.337	.486	.806
	.05 :	.000	.000	.006	.075	.179	.393	.596	----
	.10 :	.000	.000	.015	.089	.206	.476	.793	----
.20	.00 :	.000	.000	.000	.068	.168	.359	.516	.857
	.05 :	.000	.000	.010	.085	.201	.448	.700	----
	.10 :	.000	.000	.023	.107	.245	.601	----	----
.25	.00 :	.000	.000	.001	.074	.181	.384	.551	.916
	.05 :	.000	.000	.015	.098	.227	.518	.844	----
	.10 :	.000	.000	.034	.129	.295	.810	----	----
.30	.00 :	.000	.000	.002	.080	.195	.412	.592	.983
	.05 :	.000	.000	.021	.113	.260	.614	----	----
	.10 :	.000	.000	.046	.160	.367	----	----	----
.35	.00 :	.000	.000	.003	.086	.210	.445	.638	----
	.05 :	.000	.000	.028	.131	.302	.750	----	----
	.10 :	.000	.000	.064	.201	.474	----	----	----
.40	.00 :	.000	.000	.005	.095	.229	.482	.693	----
	.05 :	.000	.000	.037	.156	.358	.958	----	----
	.10 :	.000	.000	.087	.260	.654	----	----	----
.45	.00 :	.000	.000	.006	.105	.250	.527	.757	----
	.05 :	.000	.000	.048	.188	.435	----	----	----
	.10 :	.000	.000	.123	.352	----	----	----	----
.50	.00 :	.000	.000	.009	.117	.277	.582	.834	----
	.05 :	.000	.000	.063	.232	.548	----	----	----
	.10 :	.000	.000	.178	.512	----	----	----	----

STATISTICAL SURVEILLANCE PLANS

FOR

SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 50000 , T = 8760 , Po = .98 , Alpha = .05)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.286	.341	.412	.502	.624	.794	.884	.992
	.05 :	.288	.344	.416	.507	.630	.805	.898	----
	.10 :	.290	.347	.419	.513	.639	.819	.915	----
.10	.00 :	.301	.361	.435	.531	.659	.839	.934	----
	.05 :	.306	.368	.444	.542	.675	.866	.966	----
	.10 :	.311	.375	.453	.555	.695	.896	----	----
.15	.00 :	.320	.383	.461	.563	.698	.890	.991	----
	.05 :	.327	.393	.475	.582	.726	.934	----	----
	.10 :	.335	.405	.491	.605	.760	.988	----	----
.20	.00 :	.340	.408	.491	.599	.743	.947	----	----
	.05 :	.351	.422	.511	.627	.786	----	----	----
	.10 :	.364	.440	.536	.663	.837	----	----	----
.25	.00 :	.363	.435	.525	.639	.793	----	----	----
	.05 :	.378	.457	.553	.680	.854	----	----	----
	.10 :	.397	.481	.588	.731	.931	----	----	----
.30	.00 :	.389	.466	.563	.686	.851	----	----	----
	.05 :	.411	.496	.602	.743	.936	----	----	----
	.10 :	.436	.530	.651	.814	----	----	----	----
.35	.00 :	.419	.503	.607	.740	.918	----	----	----
	.05 :	.449	.542	.660	.816	----	----	----	----
	.10 :	.483	.589	.728	.917	----	----	----	----
.40	.00 :	.456	.545	.658	.802	.996	----	----	----
	.05 :	.494	.597	.730	.906	----	----	----	----
	.10 :	.541	.663	.824	----	----	----	----	----
.45	.00 :	.498	.596	.719	.876	----	----	----	----
	.05 :	.547	.665	.815	----	----	----	----	----
	.10 :	.612	.755	.947	----	----	----	----	----
.50	.00 :	.548	.657	.792	.966	----	----	----	----
	.05 :	.615	.749	.921	----	----	----	----	----
	.10 :	.704	.875	----	----	----	----	----	----

STATISTICAL SURVEILLANCE PLANS
FOR
SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 100000 , T = 8760 , Po = .98 , Alpha = .05)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.155	.201	.258	.337	.453	.648	.770	.941
	.05 :	.157	.203	.261	.342	.460	.663	.792	.972
	.10 :	.159	.206	.265	.347	.469	.680	.816	----
.10	.00 :	.164	.211	.273	.356	.479	.685	.814	.995
	.05 :	.167	.216	.281	.367	.497	.719	.862	----
	.10 :	.171	.222	.289	.379	.517	.760	.921	----
.15	.00 :	.173	.224	.290	.377	.507	.726	.864	----
	.05 :	.179	.233	.301	.396	.538	.785	.947	----
	.10 :	.187	.243	.315	.417	.574	.861	----	----
.20	.00 :	.185	.239	.308	.402	.541	.773	.919	----
	.05 :	.194	.251	.326	.429	.585	.864	----	----
	.10 :	.205	.266	.347	.461	.644	.990	----	----
.25	.00 :	.197	.255	.330	.429	.577	.826	.982	----
	.05 :	.210	.273	.354	.467	.642	.958	----	----
	.10 :	.225	.293	.385	.517	.732	----	----	----
.30	.00 :	.211	.274	.353	.460	.620	.886	----	----
	.05 :	.229	.298	.388	.514	.711	----	----	----
	.10 :	.250	.328	.431	.585	.845	----	----	----
.35	.00 :	.228	.295	.381	.497	.668	.957	----	----
	.05 :	.251	.328	.428	.570	.795	----	----	----
	.10 :	.280	.369	.490	.673	.999	----	----	----
.40	.00 :	.248	.321	.414	.540	.725	----	----	----
	.05 :	.279	.364	.477	.639	.902	----	----	----
	.10 :	.318	.420	.564	.791	----	----	----	----
.45	.00 :	.271	.350	.452	.589	.792	----	----	----
	.05 :	.312	.408	.538	.726	----	----	----	----
	.10 :	.366	.488	.664	.954	----	----	----	----
.50	.00 :	.298	.386	.499	.650	.874	----	----	----
	.05 :	.354	.464	.615	.838	----	----	----	----
	.10 :	.429	.578	.802	----	----	----	----	----

STATISTICAL SURVEILLANCE PLANS

FOR

SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 200000 , T = 8760 , Po = .98 , Alpha = .05)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.035	.074	.123	.188	.288	.473	.613	.854
	.05 :	.037	.076	.125	.192	.294	.489	.639	.905
	.10 :	.038	.078	.128	.197	.302	.507	.670	.969
.10	.00 :	.038	.078	.129	.199	.303	.500	.648	.903
	.05 :	.041	.083	.135	.208	.319	.537	.709	----
	.10 :	.043	.086	.142	.218	.337	.583	.792	----
.15	.00 :	.040	.083	.137	.211	.322	.530	.687	.958
	.05 :	.045	.090	.147	.226	.348	.594	.796	----
	.10 :	.050	.098	.159	.244	.381	.685	.963	----
.20	.00 :	.043	.088	.147	.225	.343	.564	.732	----
	.05 :	.050	.099	.161	.248	.383	.666	.907	----
	.10 :	.058	.111	.178	.275	.437	.826	----	----
.25	.00 :	.046	.095	.157	.241	.367	.603	.782	----
	.05 :	.056	.109	.177	.272	.425	.755	----	----
	.10 :	.068	.125	.203	.314	.510	----	----	----
.30	.00 :	.050	.103	.168	.258	.393	.648	.840	----
	.05 :	.063	.122	.197	.303	.477	.872	----	----
	.10 :	.080	.145	.233	.365	.609	----	----	----
.35	.00 :	.054	.111	.182	.279	.424	.699	.907	----
	.05 :	.072	.136	.220	.340	.542	----	----	----
	.10 :	.094	.168	.272	.431	.752	----	----	----
.40	.00 :	.060	.121	.198	.303	.460	.759	.986	----
	.05 :	.083	.154	.250	.387	.625	----	----	----
	.10 :	.112	.200	.323	.523	.978	----	----	----
.45	.00 :	.066	.132	.217	.332	.504	.831	----	----
	.05 :	.095	.177	.286	.447	.739	----	----	----
	.10 :	.136	.242	.393	.659	----	----	----	----
.50	.00 :	.073	.147	.240	.366	.556	.917	----	----
	.05 :	.112	.207	.334	.528	.900	----	----	----
	.10 :	.169	.300	.498	.880	----	----	----	----

STATISTICAL SURVEILLANCE PLANS FOR SAMPLING FROM STORAGE

Values shown are population proportions required to yield a minimum inventory reliability of RM where

(M = 300000 , T = 8760 , Po = .98 , Alpha = .05)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.000	.003	.048	.109	.199	.371	.508	.781
	.05 :	.000	.005	.051	.113	.206	.385	.536	.846
	.10 :	.000	.006	.053	.117	.212	.404	.570	.932
.10	.00 :	.000	.004	.052	.116	.210	.392	.538	.827
	.05 :	.000	.007	.057	.124	.225	.427	.602	.987
	.10 :	.000	.012	.063	.132	.242	.473	.694	----
.15	.00 :	.000	.005	.055	.123	.224	.416	.571	.877
	.05 :	.000	.011	.064	.136	.248	.478	.687	----
	.10 :	.000	.018	.074	.152	.278	.569	.885	----
.20	.00 :	.000	.006	.060	.131	.239	.443	.608	.935
	.05 :	.000	.014	.072	.151	.275	.542	.799	----
	.10 :	.000	.025	.087	.176	.324	.708	----	----
.25	.00 :	.000	.007	.064	.141	.255	.473	.650	----
	.05 :	.000	.019	.082	.169	.308	.623	.953	----
	.10 :	.000	.033	.104	.207	.386	.936	----	----
.30	.00 :	.000	.008	.070	.152	.274	.508	.698	----
	.05 :	.000	.024	.093	.191	.349	.732	----	----
	.10 :	.000	.042	.125	.246	.472	----	----	----
.35	.00 :	.000	.010	.076	.164	.296	.548	.754	----
	.05 :	.000	.030	.108	.217	.402	.887	----	----
	.10 :	.000	.056	.152	.299	.601	----	----	----
.40	.00 :	.000	.012	.083	.178	.322	.596	.820	----
	.05 :	.000	.037	.125	.251	.471	----	----	----
	.10 :	.000	.074	.189	.375	.818	----	----	----
.45	.00 :	.000	.014	.091	.196	.352	.653	.897	----
	.05 :	.000	.046	.148	.297	.567	----	----	----
	.10 :	.000	.098	.243	.492	----	----	----	----
.50	.00 :	.000	.016	.102	.216	.389	.720	.992	----
	.05 :	.000	.059	.179	.359	.707	----	----	----
	.10 :	.005	.134	.324	.690	----	----	----	----

STATISTICAL SURVEILLANCE PLANS
FOR
SAMPLING FROM STORAGE

Values shown are population proportions required to

yield a minimum inventory reliability of RM where

(M = 400000 , T = 8760 , Po = .98 , Alpha = .05)

BETA	d	RM=.70	RM=.75	RM=.80	RM=.85	RM=.90	RM=.95	RM=.97	RM=.99
.05	.00 :	.000	.000	.000	.055	.140	.301	.433	.720
	.05 :	.000	.000	.000	.058	.146	.316	.460	.794
	.10 :	.000	.000	.002	.062	.153	.333	.495	.898
.10	.00 :	.000	.000	.000	.059	.149	.319	.458	.762
	.05 :	.000	.000	.003	.067	.162	.352	.523	.952
	.10 :	.000	.000	.008	.075	.177	.396	.618	----
.15	.00 :	.000	.000	.000	.063	.159	.338	.487	.810
	.05 :	.000	.000	.006	.076	.180	.397	.604	----
	.10 :	.000	.000	.016	.090	.208	.485	.818	----
.20	.00 :	.000	.000	.000	.068	.169	.361	.519	.864
	.05 :	.000	.000	.011	.086	.203	.455	.714	----
	.10 :	.000	.000	.025	.109	.249	.621	----	----
.25	.00 :	.000	.000	.001	.074	.181	.385	.555	.924
	.05 :	.000	.000	.016	.099	.230	.529	.871	----
	.10 :	.000	.000	.036	.133	.303	.854	----	----
.30	.00 :	.000	.000	.002	.081	.196	.415	.596	.995
	.05 :	.000	.000	.022	.115	.264	.630	----	----
	.10 :	.000	.000	.049	.165	.379	----	----	----
.35	.00 :	.000	.000	.003	.087	.211	.448	.644	----
	.05 :	.000	.000	.030	.134	.309	.779	----	----
	.10 :	.000	.000	.068	.208	.498	----	----	----
.40	.00 :	.000	.000	.005	.096	.230	.487	.701	----
	.05 :	.000	.000	.039	.160	.368	----	----	----
	.10 :	.000	.000	.093	.273	.701	----	----	----
.45	.00 :	.000	.000	.007	.106	.252	.533	.767	----
	.05 :	.000	.000	.051	.194	.451	----	----	----
	.10 :	.000	.000	.131	.375	----	----	----	----
.50	.00 :	.000	.000	.009	.118	.280	.588	.848	----
	.05 :	.000	.000	.068	.242	.574	----	----	----
	.10 :	.000	.000	.194	.556	----	----	----	----